Narrative Affordances of Scale in VR:
Remediating Traditional Iranian Storytelling

Seyed Moslem Tabatabaei

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By: Seyed Moslem Tabatabaei

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Signed by the final examining committee:

_____ Examiner
Dr. Pippin Bar

_____ Examiner
Dr. Rilla Khaled

_____ Thesis Supervisor
Dr. Jonathan Lessard

Approved by _____
Dr. Martin Racine, Graduate Program Director

_____
Dr. Annie Gérin, Dean, Dean, Faculty of fine arts

Date: **9 December 2020**

Abstract

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Virtual Reality is turning into a major and more accessible medium to spatial, interactive and linear narrators, aka architects, game designers and filmmakers. This research-creation is conducted with two main objectives: first, to investigate the unique narrative possibilities that VR affords as a result of its specific perceptual cues of scale. Second, to utilize the notion of scale in designing a remediated experience of a traditional screen-based form of storytelling in the Iranian culture known as *Pardeh-Khani* (literally translated as: reading off curtain/screen). In response to the first objective, possible ways that scale could leverage three distinct forms of immersion in VR were scrutinized under three isolated experiments. Also a broad range of VR and non-VR cases, from cinematic to fully interactive games which revolve around the idea of scale were studied. The key takeaway was that exploiting a dynamic scale of virtual embodiment could lead to spatial experiences, gameplay mechanics and cinematic communications particular to VR. Following the second objective, M.C Escher's *Relativity* (1953) became a key inspirational source for designing an impossible architecture which incorporates a malleable scale of embodiment but also hosts the spatiotemporal ritual of *Pardeh-Khani*. The challenges of and possible solutions for designing the navigational structure of a surreal spatial experience in a room-scale VR are discussed in detail. This research-creation explores the medium-specificities of VR with a multidisciplinary approach from one side. From the other side, it raises the awareness about a marginalized tradition of storytelling through the lens of cutting-edge technology of VR.

Keywords: Virtual Reality, Immersion, Scale, Virtual Embodiment, Remediation, Pardeh-Khani, Traditional Storytelling, Spatial Narrative, M.C. Escher

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Table of Contents

List of Figures

Chapter 1 | Introduction

Because of its strong potential for immersion, VR has been a major focus of research and creation for various disciplines of art, design and storytelling. The increasing accessibility of VR technology, especially in the past few years, has encouraged the publication of a great variety of content providing ample material for both researchers and creators[1]. Having a background in architecture and 3D animation, it seemed natural for me to move on to the immersive mediums and VR in particular, which incorporates both visual and spatial features. My initial line of inquiry was if and how my architectural design and storytelling skills could be synchronized with the particularities of VR to tell *immersive* stories.

Immersion has been so frequently used as a commercial buzzword that it has somewhat lost any precise meaning. However, dismissing immersion in the academic discourse on VR appears to me like neglecting God in a religious school. After all, VR has been promising the highest level of immersion for a long time and it is now bringing a variety of specialities together, to whom the term immersion is not necessarily interpreted the same way. It is because the objectives, priorities and use cases could be completely different for each discipline: architects are attracted to this medium for the hope of sharing a more true-to-life simulation of the spatial experience of their projects to their clients, filmmakers seek for a more immediate presence of their audience in the story world and closer connection to its character, as for game designers and software engineers, intuitive and natural interactions of the players/users also becomes an important factor in how they define immersion.

Immersion is sometimes interchangeably used with other abstract terms like *presence* and *transportation.* Burcu Dogramaci & Fabienne Liptay, editors of the book *Immersion in the Visual Arts and Media* (2016) introduce the term immersion as "any act or experience of plunging into something, without necessarily applying to computer-generated virtual environments." (1) They draw upon the notion of the *liquid spaces* which appeared before the creation of digital/virtual spaces; which is the idea of the *images as windows* or mirrors through which the viewer is invited

[1] Due to the urgency of remote communications as a result of the global pandemic, social interactions through VR have started to make even more sense.

to immerse themselves into the liquid spaces of the artworks (2). This brings to mind the "Logic of Transparent Immediacy" coined by Jay David Bolter and Richard Grusin in the book *Remediation: Understanding New Media (1999).* They describe this logic as one of the preoccupations of the contemporary media which attempts to efface the medium interface and to produce experiences without mediation. VR is considered as the manifestation of this logic whose purpose is to disappear. They remind us that the same desire (of creating a transparent interface) existed throughout the evolution of older mediums like painting and photography. The technique of linear perspective in particular was a major but not a sufficient step in dissolving the picture into the reality around the canvas (24-25).

A similar concept to immersion in terms of complexity and ambiguity is *realism* which has been one of the most debated notions in cinema. In the cinematic discourse, the idea of a perfect realism (a full immersion) is usually linked to the notion of the "myth of total cinema" coined by well-known film theorist André Bazin. He considers the evolution of cinema a response to an ongoing desire for "reconstruction of a perfect illusion of the outside world in sound, color, and relief" (Bazin in Prümm, 2016 :142). Like immersion, various types of realism have been introduced by different film theorists throughout the history of cinema, each trying to explain the formal and social elements which could transport the audience into the fictional world. I found the concept of *perceptual realism* first coined by Stephen Prince (1996) very helpful in developing the initial question of this research. As opposed to *photo realism* which solely relies on photo-indexical references, perceptual realism is created from any signifier from the virtual world which anchors the spectator to the audiovisual experience of their daily life in a real three-dimensional space (not only to the photographed images). These signifiers are referred to as *perceptual cues* by Prince.

Inspired by the notion of perceptual realism, my first major objective was to explore the VR-specific perceptual cues that could leverage the sense of immersion. After experiencing different VR contents, it became evident to me that there is something special about how we perceive *scale* in VR. My assumption was that the manipulation of scale of the entities in VR could bring about unique narrative affordances. In other words, I believed that the medium-specificity of VR possibly relied on the notion of scale. My two main methods for examining this assumption have been comparative case-studies and prototyping with scale in VR. Besides my own reflections in a form

of autoethnography, feedback from those who tested the experiments along the way are what shapes the core of my discussions. I have been documenting the takeaways of each major playtest session as well as meetings I had with the collaborators who helped me program the interactions and create the artwork assets (appendix).

Fundamental Components of the Gameplay Experience: Analysing Immersion (2005) by Laura Ermi and Frans Mäyrä was a key literature for creating a framework under which I could channel my case-studies, and start early experiments with scale in VR. Among different forms of immersion, I found their proposed model simple yet overarching which as a result allowed analysis of the scale in a wide variety of VR narratives that each engage the experiencer differently. In the next chapter (2nd), I will elaborate on the question of scale; why I find our perception of scale in VR different than in other screen-based forms of representation. Then I will go through some of the use-cases of scale in non-VR mediums and games in particular. In the third chapter, I will first overview some of the technological distinctions of VR which affect our perceptual cues of scale. Then, I will focus on VR examples which have exploited scale in one way or another.

The second objective of this project was to utilize the specificities of VR and narrative affordances of scale in particular, to create a standalone prototype which merges facets of linear and spatial narratives. Even before delving into VR and raising the question of scale, I was musing how the mediation of Augmented Reality (AR) could manipulate the architecture of *Hijimi Museum of Literature* (Tadao Ando, 1991) and make it an ideal place to experience the sequences of *Spirited Away* (Hayao Miyazaki, 2001) one by one. Is there any need to alter the physical architecture and/or the story and its cinematic direction in order to mix these realities more naturally? After I decided to focus only on VR and skip AR and other immersive mediums, still I needed to answer questions like: what genres of screen-based contents and what kinds of architectural spaces are ideal for the amalgamation of spatial and linear narratives in VR?

Eventually, I went for the remediation of a traditional screen-based form of storytelling in Iran known as *Pardeh-Khani* which is now almost extinct. In the fourth chapter, I will first explain how Iranian traditional culture became my main source of inspiration. Then I will discuss how M.C. Escher works and *Relativity* (1953) in particular came to inspire the design of a VR-specific space

which also suits *Pardeh-Khani*. And finally I will go through the steps that have been taken to mold the temporal structure of the experience, and will conclude the chapter with the questions yet to be answered.

Chapter 2 | Question of Scale

Scale in its spatial sense is the relative size of things. It is our understanding of how much space objects occupy in relation to ourselves, to each other and to their surrounding space. Scale is generally a fixed parameter in the real world and we don't notice objects' change of size as much as we see them move and rotate. Change of objects' volume usually occurs gradually and through the slow and organic processes of metamorphosis or erosion in the physical world. Scale is relational and the *Ebbinghaus Illusion* (fig.1) is a proof that without measuring tools, our perception of scale is completely relative. So we compare the scale of things in relation to a reference. In the physical world, there are objects that have become our perceptual yardsticks by which we comprehend the scale of everything else. The size of our body is perhaps our first and foremost benchmark. But other natural bodies like trees as well as some of our own artifacts like furniture and vehicles come to assist. It is the *relativity* and *invariability* of scale which make its exaggeration and manipulation in the physical space evoke strange emotions and communicate certain meanings.

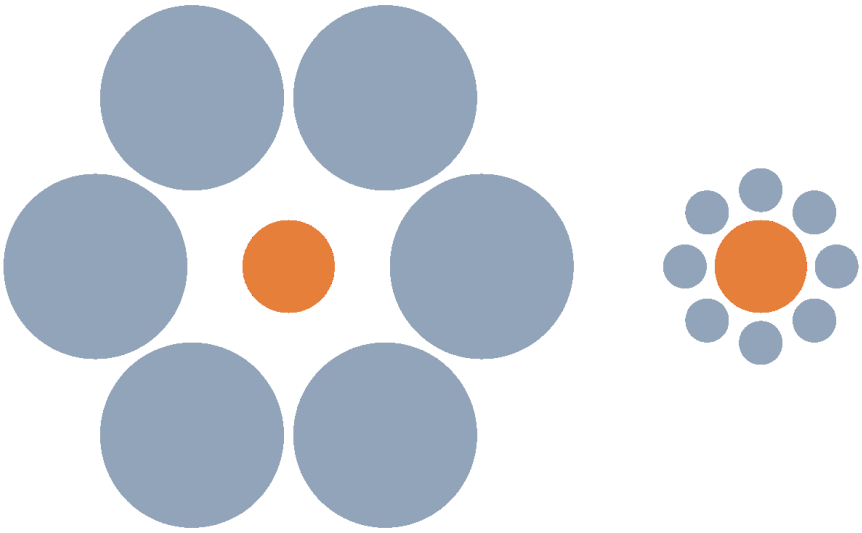

Fig 1. Ebbinghaus Illusion | An optical illusion also known as Titchener circles in which'... a circle surrounded by other circles will appear smaller if the surrounding circles are enlarged...' (Barile, n.d.). Image retrieved from: https://en.wikipedia.org/w/index.php?title=Ebbinghaus_illusion&oldid=981656398

There are plenty of architectural examples, sculptures, urban installations and land arts whose popularity is mostly warranted by their unusual scales. Sacred spaces and statues are the classic examples of overemphasized use of scales usually to make visitors awed and impressed. The contemporary examples are those usually referred to as novelty architectures, in which the building literally takes its form from a familiar object of a totally different size. The Big Basket building (Longaberger Company, 1997, Ohio) is a good example in which scale is used merely as an advertisement tool. Oversized sculptures of Claes Oldenburg like *Floor Burger* (1962), are the examples of scale serving critical practices in a satirical form. The unusual scales of the physical objects and spaces play a significant role in creating landmarks and shaping the memories of a place.

Our understating of scale in analog/tangible mediums of representation (a 2D painting for instance), is affected by our mental image of the represented subject. But it is also the physical frame of the canvas that impart in shaping our perception of scale. In the architectural and engineering drawings which are typically printed on standard-sized papers, the scale of the represented building has a standard ratio relative to its real world equivalent, and this ratio is annotated typically in the form of scale bar. Scale bars as well as the drawn figures (human, car, tree, tiles, etc.) act as scale references by which we could better estimate the size of the real artifact.

In screen-based mediums (ex. cinema), the scale of the represented entity becomes dynamic. Still a frame (screen borders) with a quite standard size and aspect ratio remains as the main reference to our perception. Actually, the size of recorded entities in front of the camera relative to the screen frame is known as *field size* which is one of the fundamental components of the cinematic language. Close-ups, Medium Shots and Long Shots are the three primary ranges of the field size. Technically speaking, field size is created from a combination of the camera's field of view (FOV) and the distance it has from the entities (depth). Field size could be considered a compositional/spatial use of scale, but when it is set in motion (i.e. zooming effect) it also contributes to the temporal scale.

Scale in the digital/interactive mediums is the third transformation attribute after movement and rotation in the Cartesian coordinate system of the virtual space. The fact that virtual objects/spaces

are no more camera-recorded in Computer Graphic Imagery (CGI) but fully simulated, makes their scale as malleable as their other two parameters. Movement, Rotation and Scale have become the standard transformation tools equally vital to most 2D and 3D graphic software. However, I have not found scale to be exploited in video games as much as the other two parameters. This is especially true in the photorealistic and plot-driven games because scale change has less indexical reference to our daily interactions with real objects. Same is true for VR games. VR is a digital and inherently more interactive medium than cinema and game designers have been perhaps the most active group experimenting with it. Before delving into VR examples in the next chapter and pointing out its fundamental differences with other screen-based mediums, I will first go through some of the uses-cases of scale in non-VR screen-based games.

Scale in Screen-Based Games (Non-VR)

I found some of the most straightforward examples of playful and creative use of scale among the casual mobile games. They usually have an abstract visual style in which the size of entities prompts meaningful interactions. One of them is *Scale* (2017) from Good Job Games which is a 2D arcade mobile game (fig.2). Your target is to cut a pool-like board by placing a slicer in different spots and directions and shrink down the board size. The challenge is to watch out a ball that is bouncing around while you are placing the slicer, so that it does not hit the slicer before the cut is completed; as the board gets smaller and more irregular in shape the challenge gets tougher.

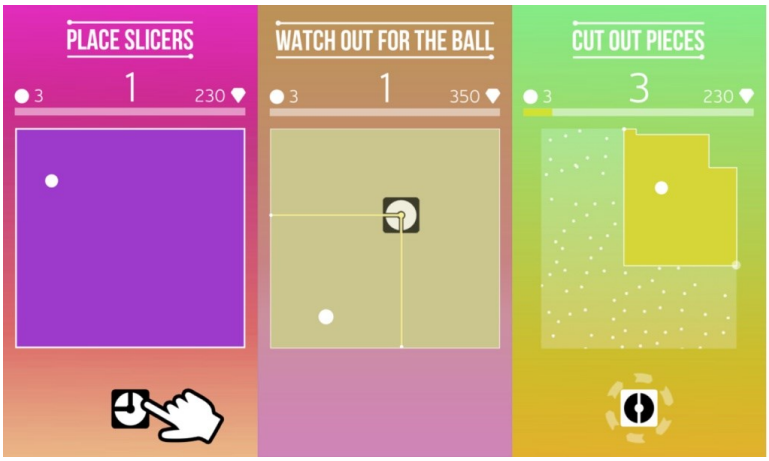

Fig 2. (left three images) Scale (Good Job Games, 2017), Retrieved from: searchman.com/ios/app/us/1200921809/en/good-job-games/scale

Fig 3. (right) Stack (Ketchapp, 2016), Retrieved from: ketchappgames.com/games

Stack (2016) from Ketchapp is another mobile game with a similar geometric aesthetic (fig.3). Your challenge is to stack the falling boards on top each other as high as you can; the less accurate your alignment is, the larger pieces from the top board fall off which leaves you with a smaller area for the next coming board that is now smaller.

There are also action adventure games with less abstract visuals whose gameplay is centered around the character's change of scale. *Super Mario Bros.* (Nintendo EAD, 1985) is a classic example in which the character's scale not only represents the power up mechanics and players ability to do certain actions but also it affects whether you can navigate through certain roots or not. In more contemporary casual games like *Feed and Grow: Fish* (Old B1ood, 2016), the whole game is about eating the smaller, getting bigger while running away from the bigger to the point where you are the biggest.

In some of these games, the scalable character is or becomes an abstract matter like a rolling ball or a black hole, while the surrounding world remains fictional. In *Katamari Damacy* (Namco, 2004) you roll a sticky ball around which absorbs smaller props it collides with like toys and furniture to its surface and progressively gets bigger than even cities and continents on the planet. You should grow into a specific size within given time frames. The ball's diameter updated in the UI keeps you motivated for the progress and is also a reminder of the pivotal role that scale plays in this game. *Donut County* (Ben Esposito, 2018) is another game with a similar approach; you drag a hole on the ground which can swallow whatever fits into its current diameter and as such it gets bigger and bigger. Puzzles are simple and mainly around the order of picking things. Scale mechanic serves the juicy and pleasant interactions in this game.

Change of scale in many of the mentioned games seems to have merely a satisfying effect, rather than creating complicated puzzles. Part of this satisfaction might come from the gradual adaptation of the camera view which automatically fits the enlarged or shrunken objects within the frame; this as a result makes the surrounding objects and environments look smaller or bigger accordingly. Such a change in viewing scale (field size in cinematic context) is not always automatic and becomes the quintessential interactive element in many strategy and open world games. *Sins of a Solar Empire* (Ironclad Games, 2008) is a great example; the epic dynamic range of the viewing

scale is central to the gameplay and aesthetics of this game. You can instantly fly from the god view of an entire universe down to the galaxies, planets and even to the details of your spaceships. Change of viewing scale is barely confused by the player with the entities' change of scale. Viewing scale in all of the mentioned games so far plays a key role in shaping the boundaries of the game world and setting the player's expectations as to what parts and items are interactive.

None of the mentioned games so far were first person perspective (FPP). Change of the viewing scale in a FPP game (which offers the closest experience to VR) gets tricky somehow as it could become the equivalent of the player's change of scale relative to the surrounding environment. I hardly encountered examples that require the player change their size or embody different characters of various sizes and abilities. *Dishonored* (Arkane Studios, 2012) was one of the few examples; it is an action-adventure game set in a plague-ridden world. Among the ten different powers available to the player, 'Possession' let's him hijack another character's body temporarily and take actions stealthily. You can possess a rat body and enter into pipes and passages that cannot hold a human body. 'Blink' is another power which is basically a teleportation mechanism that incidentally has a strong place in VR navigation design. Change of player's scale is not as vital as teleportation in this game, but it feels as cohesive to its designed world.

Among the Sleep (Krillbite Studio, 2014) is another FPP game which is centered around the player's scale. It is a survival horror adventure game; you are playing as a two-year old child in a nightmare quest for your missing mom at the risk of facing creepy atmospheres. The whole weirdness of this game is in its low and wide angle perspectives which situates the player in a peculiar relationship with familiar objects in unfamiliar proportions. This is a direct reminder of another horror adventure game *Little Nightmares* (Tarsier Studios, 2017); it is not a FPP experience but similarly puts a tiny child character in interaction with the exaggerated world of monstrous creatures. It proves the psychological weight that scale manipulation could have which makes it suitable for this genre. However, scale in both of these cases doesn't really lead to unique challenges as much as it enhances imaginary engagements with their surreal environments and characters.

Like the viewing scale, change of entities' size seems not to be exploited widely in FPP games. The experimental game *Scale* (2012) by Steve Swink is one of the few examples. You have a gun-like device with which you can scale all sorts of entities in front of you up and down; you can change for instance a small toy house into a place you can walk in or shrink a monster down into a tiny toy you can carry with yourself. Your navigation and progress relies on changing objects' scale which in return allows you certain interactions with them. Scale of objects in *Superliminal* (Pillow Castle, 2019) are changed in a very creative and illusive fashion (fig.4). For instance, you pick a chess piece up which is close to you and start dragging it into different spots in various depths of the room. While doing so, its scale automatically adapts; it gets smaller as it comes closer and bigger when it gets farther. Since its relative-to-frame scale stays the same, you do not notice that its scale relative to its surrounding is constantly changing, until you drop it. This means that the scale mechanic of this game takes the advantage of both objects' scale and the viewing scale at the same time.

Fig 4. Superliminal (Pillow Castle, 2019), Retrieved from: pillowcastle.org/presskits/superliminal/

To sum up, one common feature of all the mentioned games is that scale seems to be a very strong asset to their explorative nature; by shaping unique structures of navigation it could effectively contribute to exploration/adventure games. The *invariably* of scale in the physical world makes its manipulation in the screen-based forms of representation evocative and meaningful. It is its *relativity* which makes our perception always pendent to a reference; especially to our own *body* in the real world and to the *frame* borders in the screen-based mediums.

Chapter 3 | Scale in VR

Unique narrative potentials of scale in VR started to become evident to me by going through many different VR experiences, from less interactive 360 cinematic contents to fully interactive VR games. I went through those experiences mostly in Phi center's major VR events (Montreal), as well as digital platforms like Steam, Oculus and Windows Mixed Reality. Those which harnessed scale in some way were the most awe-inspiring ones to me. *Dear Angelica* (Oculus Story Studio, 2017) was certainly an exceptional narrative in that regard. It is a less than 15 min VR experience unfolding in a linear fashion with some subtle interactivity. The cinematic and affective use of scale in this work, made me ponder what other affordances scale could bring about in various contexts and at different levels of interactivity. Before analysing this work in detail and other use-cases of scale in VR, I will first argue over the fundamental differences between VR and other screen-based mediums which affect the perceptual cues of scale. I will then segue into the framework I used to study how as a result of these medium-specific differences, scale could contribute to three specific forms of immersion. My case studies and experiments with scale in VR are channeled under this framework.

One of the first significant changes that we notice when jumping into VR is the absence of the frame. Scale in VR is no more *relative* to a frame as it used to be in the other screen-based mediums, and is no more *invariable* as it is in the physical world. With the frame gone, it is once again our own body which we intrinsically try to grab as the scale benchmark, but that is also replaced by our virtual embodiment (avatar) whose scale is as flexible. Regardless of such liquidity of scale, I found myself much more sensitive to scale in VR, and even minor misproportions of things are clearly noticeable. Following are some of the technological/hardware particularities of VR which make the experience of scale in VR so unique.

Framelessness of the medium

In a screen based medium, the size of an entity is not only determined by its proportions relative to its surrounding entities, but also the viewing scale (FOV coverage) or size relative to the screen frame. This relation has become something taken for granted due to the long history of interacting through the mediation of the screen. The viewer intuitively ignores taking their own size as a

benchmark. This established literacy of the frame is precisely what keeps the audience feels safe in front of the screen, no matter how gigantic that projected train on the screen is and how fast it is running towards them. I found part of the reason why experimentation with scale in VR is still uncomfortable to people is such naivety. However, an almost complete disappearance of the screen frame makes the player always situated within the virtual space. Conversely, the screen interface in a frame-based medium always situates the player outside the virtual world and even a first person perspective (FPP) doesn't help this detachment from the player character. In other words, the frame is always a barrier in letting you embody the change of scale.

Fixed Hardware FOV

There is no adjustable FOV for the virtual reality camera very much like our eyes in reality (you cannot zoom with your eyes). It is a given hardware specification which could vary for each Head Mounted Display (HMD). Although the change of camera angle and field of view in non-VR FPP games could provide the *effect* of the player's change of scale, it could hardly convince its *illusion*.

No Depth of Field Effect

Depth of Field (DOF) in the flatscreen mediums is a photographic effect by which objects at a certain distance from the camera are depicted sharp and the rest are blurred out. Technically, it is either a direct product of the lens' optical behaviour when it is a pre-recorded image, or a simulation of it when it is CGI. The importance of DOF lies in the fact that it is a depth cue which helps the eye/brain with better evaluation of the objects' distance and scales relative to each other. The issue is that VR is actually an immediate emulation of our eyes rather than a mimic of a monocular camera and all its optical effects. However, only HMDs which are equipped with eye tracking technology are capable of emulating the eye's DOF, and most of them are not at the moment. In the absence of DOF effect, atmospheric effects (aerial perspective) like haze and fog could partly compensate for the lack of this important depth cue. They make objects in distance look paler and less detailed and I found them especially effective for visualizing big objects in VR.

Virtual Interpupillary Distance

Interpupillary Distance (IPD) is the distance between the centers of the pupil of the eyes. It is what grants us the stereoscopic view of the world. In reality, IPD is an almost fixed value for each person

and only changes a few millimeters based on whether you are looking at a distant or a close object. In VR, its virtual equivalent (Virtual IPD) could be adjusted technically by modifying the distance between either two virtual cameras in the 3D game engine, or two lenses of the stereoscopic recording camera. The result is the illusion that your eyes, head and body is scaling up or down. From my experimentation, the player's virtual height which imposes the angle of view, comes to play an important role in conjunction with virtual IPD; it convinces the player's change of scale and prevents the confusion of floating in the air. Virtual IPD is as important as FOV in creating the illusion of player's change of size in non-VR FPP games. It also supplements an important depth cue that is *motion parallax*[2].

To sum up, framelessness of the VR, its fixed FOV, absence of DOF and accessible virtual IPD undermine some of the established depth/scale cues of the non-VR mediums and instead spark off new ones. As a result, the experience of *viewing scale* becomes quite unique in VR, and this paves the way for designing VR-specific experiences. Nonetheless, it makes conversion of some non-VR games like *superliminal* (Pillow Castle, 2019) challenging if not impossible. In this game, the scale of the object automatically adapts to its movement in depth so that it always looks the same size (relative to the frame). This way, scale change is temporarily masked by the viewing scale. In VR, the virtual IPD makes the trick fail as it enhances our 3D spatial evaluation of the objects, and hence does not allow their scale change to be easily concealed or confused with viewing scale.

Such fundamental differences also impact the camera *viewing and framing* conventions. For instance, there is no extreme zoom effect in VR, and no isometric view to make you feel dominating over the virtual world; also there is no physical division (i.e. a touch screen) to put you in command and control position. Usually "Bird's Eye View" and "God's Eye View" are interchangeably used in non-VR screen-based mediums. We could perhaps assign distinguishable definitions to them in VR; It is our excessive scale and not our distance which grants us power (God's eye), and it is our distance from the designed stage that makes us feel floating in the air

[2] "Motion parallax is a monocular depth cue arising from the relative velocities of objects moving across the retinae of a moving person. (...) It is perhaps easier to think of what motion parallax is by imagining yourself as a passenger in a car looking out the side window. (...) The objects very close to the window, such as the small trees planted by the highway, seem to rush by [and objects in distance appear to move slowly]..." Retrieved from isle.hanover.edu/Ch07DepthSize/Ch07MotionParallaxExpl.html

(Bird's eye). No matter how big or how far we get, we cannot get a real distance from the whole virtual world (as long as the HMD is on).

In the following part of this chapter, I will cover some of the use-cases of scale in VR through the lens of a specific model of immersion that helped me categorize these examples and do my early experiments with scale under the same categories.

SCI Model of Immersion

As mentioned in the introduction, *immersion* has been one of the most debated concepts in different disciplines of arts and media studies. Depending on the medium, many forms of immersion have been introduced by various scholars. To study the role of scale in different VR narratives and analyse its possible influences on their level of immersion, I needed an overarching model. My concern was on the audience' engagement in different narrative scenarios. Before introducing the model I eventually used, I will first go through a few literature on the notion and types of immersion in VR.

Katja Kwastek in *Immersed in Reflection? The Aesthetic Experience of Interactive Media Art* (2016) refers to Virtual Reality merely as a form of interactive art, even though not all VR experiences demand an intense participation (and hence are usually referred to as cinematic VRs). To distinguish immersion of the interactive media from that of non-interactive, she draws upon the notion of *flow*[3] which is a familiar concept in the discourse of game design. In doing so, she somehow equates immersion with flow; aesthetic experience of the interactive arts (media) consists of two essential counterparts, namely the *reflection* or *aesthetic distance* and the *immersive experience of the flow* (83). She provides insight into the tension that exists in the assessment of the reflection process (aesthetic distance), which is sometimes put in parallel with and other times against the absorption. However, she doesn't directly allude to the fact that the reflection itself could perhaps be conceived of as a form of immersion and part of engagement

[3] Coined by Mihály Csíkszentmihályi, experience of flow is a result of factors like: "focused concentration on the action, loss of self-consciousness, merging of action and awareness, intrinsic motivation, clearness and achievability of goals, and control over the situation" (Csíkszentmihályi in Kwastek: 69)

with especially critical arts/practices. Besides, there are plenty of immersive VR experiences that don't rely on the notion of flow altogether and for instance create the engagement cinematically.

In *The VR Book: Human-Centered Design for Virtual Reality* (Jerald, 2015), immersion is distinguished from the sense of presence. It is described as something objective and related to the characteristics of the technology, whereas the presence is the subjective experience of the immersion and affected by the internal physiological state of the audience. According to Jerald, presence in VR is created on grounds of four illusions, namely: being in a stable spatial place, self-embodiment, physical interaction and social communication (45-49). Similarly, in the book *Understanding Virtual Reality* (Sherman & Craig, 2002), immersion is categorized as only one out of four key elements of the virtual reality experience, namely: virtual world, immersion, sensory feedback and interactivity (6). Both of these books had been my very early references to VR and among the first insightful sources for understanding the medium-specificities of VR. However, these books and references alike approach VR from a scientific/objective point of view, and consider immersion merely a technological byproduct of the medium, rather than a base for evaluating the type and level of engagement of the audience in various narrative contexts.

Eventually I found the model introduced in *Fundamental Components of the Gameplay Experience: Analysing Immersion* (Ermi & Mäyrä, 2005) an overarching framework through which I could analyse engagement with VR contents of a wide range of narrative qualities. It is not a VR-specific model though, and the components by which the sense of immersion is leveraged in the video games are examined under three main categories, namely: *Sensory*, *Challenge-based* and *Imaginative* modes of immersion (SCI model). Each one could be accounted for a unique narrative setting which will individually be explained in this chapter. I will investigate relevant examples under each category including my own experiments with scale in VR. The key advantage of using this model is that it evaluates the level of immersion based on how the experiencer describes their engagement with the gameplay/content rather than how the mechanics and the contents are designed. From there, I was trying to analyse all the VR (and non-VR) experiences I encounter through the lens of the proposed model and see if/how the scale is central to any kind of narrative engagement. First category is the sensory immersion which is somehow an entry point to other modes of immersion.

Scale and Sensory Immersion

According to the SCI model, the *sensory* mode of immersion is tied to the technological capacity of the medium in detaching the experiencer from the real world and wiring them into the virtual. Attributes like higher resolution, frame rate, three dimensionality, level of rendering and texturing details, and audiovisual qualities, which all increase the *spatial immersion* fall into this category (Ermi & Mäyrä, 2005). The added spatial cues in VR intensifies this immersion. In that sense, VR is arguably a next-gen technology and an important step towards an increased sensory immersion when compared with prior screen-based mediums.

Experiment 1: PlanetS | Size Differences

For the first experiment, I chose to visualize the solar system as it is a domain of extreme scale differences. The idea was to examine the sensory effects of encountering the familiar planets with relatively correct proportions in the same space (fig.5). It was specially designed to observe how visceral the reaction would be when confronted with the Sun which is massively larger than all other objects. Such a huge difference is perhaps the main reason why we usually don't see their relative sizes (and distances) accurately depicted in books and other flat-screen mediums and even inside the physical museums. Notably, I had not used any game engine prior to these experiments. Therefore, another purpose of starting with isolated prototypes without concentration on any specific content was to acquire the technical skills of using a game engine like Unity and its programming language C#.

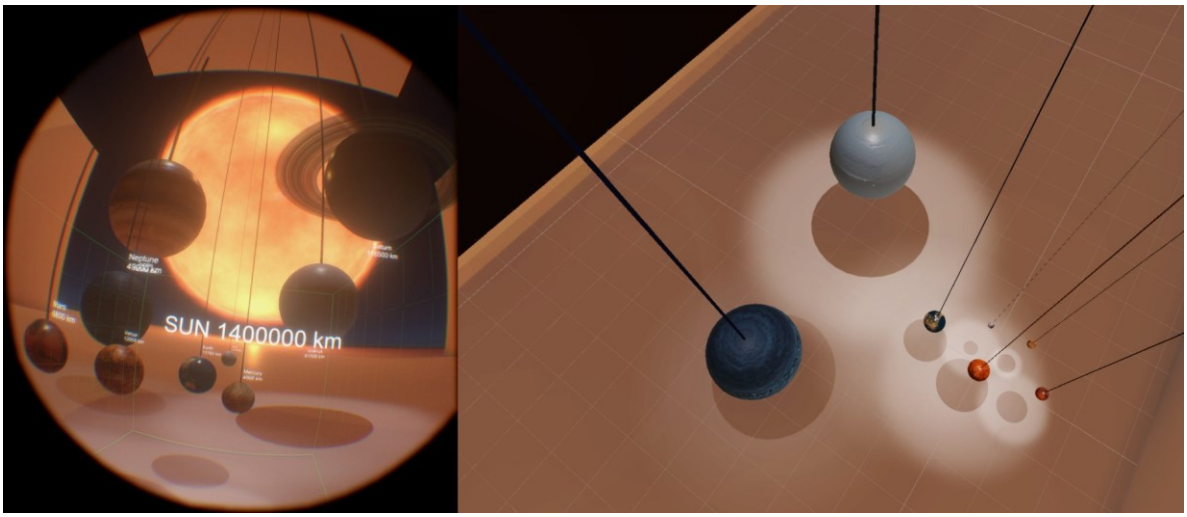

Fig 5. Experiment 1: PlanetS | I wanted to convey a museum-like setting where all the objects are hanging from the ceiling (except for the sun) and orbiting with slow but different paces. Planets were arranged in a zigzag pattern which encourages the viewer to approach them one by one.

I tried as much as my visualization skills and rendering capabilities of Unity allowed, to enhance the texture, realistic look and spectacle with common techniques like Global Illumination (GI), Ambient Occlusion (AO), particle effects for the Sun and some general post processing effects. A little bit of fog was also added just as a depth cue. To remind the non-fictional context and the accuracy of the relative sizes, I placed textual information (diameter in kilometers) above each planet which gets visible when the viewer walks close to them. I also wanted to create suspense before revealing the Sun, so I hid it behind a giant wall which opens up only when the viewer approaches a certain distance from the Earth. To dramatize this gradual revelation I also added the music track *Alpha* from *Albedo 0.39* album[4] (Vangelis, 1976). The music was sliced in small audio clips, each one triggered when passing by the planets one by one so that when the Sun shows up, the music climax is also played.

It was interesting to see some playtesters (from faculty/cohorts) wanting to grasp the planets with both hands or bend over or underneath them, which is proof of a sensory immersion. There was a clear level of astonishment when the Sun was revealed but not really that visceral reaction I was anticipating. For some, the giant surrounding walls felt like frames of a big poster of the Sun. Also the visibility of the text I used is not occluded by any object and its size stays the same, regardless of how far the Sun is positioned. This might be another reason why it was not perceived as large as it really was. Perhaps the more emphasized atmospheric effects like haze could have magnified the scale and depth cues too. I later experienced a successful example of the visceral impact I was trying to achieve in *Irrational Exuberance: Prologue* (Buffalo Vision, 2017) where you find yourself in a small cave-like room at the beginning. It is only by breaking the walls around you that you suddenly see a colossal planet behind and realize that the room is actually floating in outer space.

Realistic visualizations could serve both sensory immersion and simulation purposes. Even non-fictional topics which merely rely on spatial simulations of natural phenomena of extreme scales (micro or macro) benefit a lot from this type of immersion. Later I came across several educational and documentary VR experiences which had cosmic themes. *Orders of Magnitude VR* (Filip

[4] It is a concept album themed around space physics. Its title is inspired by the idea of a planet's albedo (Wikipedia)

Vesely, 2020) is "An educational Virtual Reality experience which will show you our Universe at many different scales." It visualizes a wide range of scales from the whole universe down to the electron cloud, but rather in an artistic fashion. Another good example is *Home - A VR Spacewalk* (BBC, 2017) which I had the chance to try at Phi Center. It simulates the astronauts' spacewalk experience in an authentic way, and it was incredible and quite visceral to see our gigantic blue planet beneath my feet.

The most inspiring example was the *SPHERES* (2018) by Eliza McNitt which I also experienced at Phi Center in 2019 (fig.6). It consists of three independent chapters each about a specific subject: 1. *Chorus of the Cosmos* (about our solar system), 2. *Songs of Spacetime* (about the black holes) 3. *Pale Blue Dot* (about the big bang). The voice-over provides information about the subjects in a poetic fashion but also sets a time-frame for each part. Audiovisual effects, rendering details and haptic interactions have major contributions to the spectacle and sensory immersion.

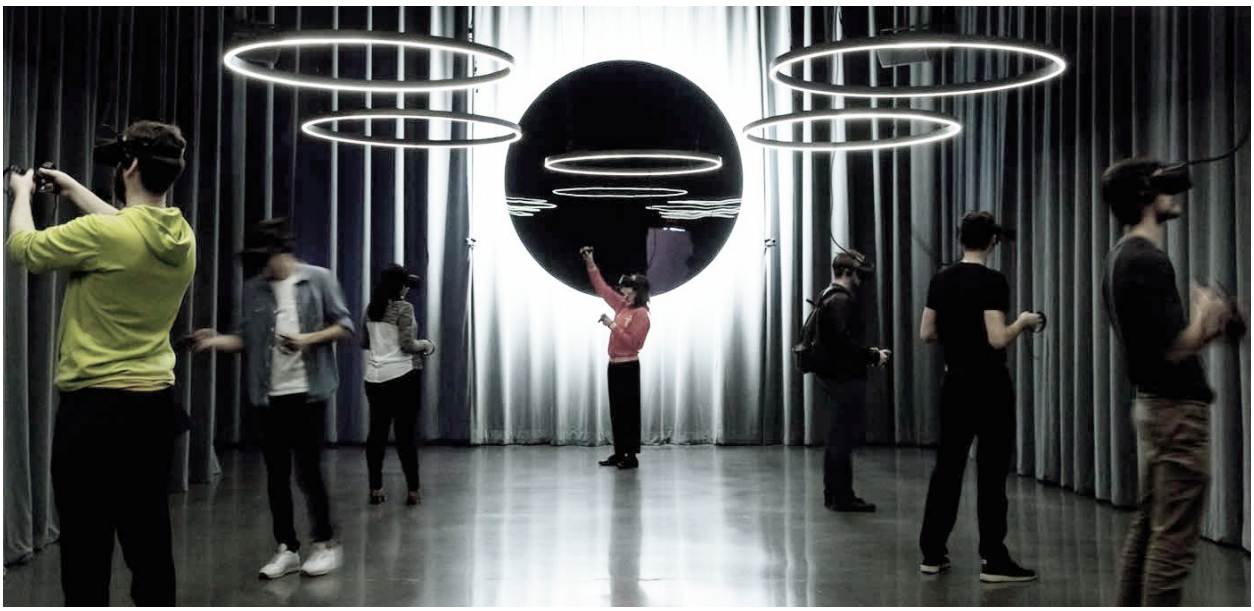

Fig 6. SPHERES (Eliza McNitt, 2018) | Long black curtains and floating light rings from a dark painted high ceiling was making the space feel infinite. The reflection of the lights rings in the large circular mirror at the end of the room was visually expanding the space. Photo retrieved from: phi-centre.com/en/event/echo-2018-en

Creative use of scale also plays an important part; for instance, the first chapter visualizes the solar system in a small scale while planets are within your hand's reach and you can interact with them like a bunch of tiny marbles. But in the next chapter you are drawn into the center of a black hole; until you embody it while drawing another star and a black hole towards you. And in the last chapter you will again encounter the planets of the solar system, but this time on a much larger

scale. Installation design of this work was also bringing a level of sensory immersion to the physical space.

Sensory immersion within the physical installation of the *SPHERES* reminds me of *The Weather Project* (Olafur Eliasson, 2003), in which a giant illuminating sun seems floating at the far end of the hall, surrounded by very tall walls reaching up a reflective ceiling. Patina Lee in *Oversized Art - Is Bigger Really Better?* (2017) mentions that the immersive characteristics of its space make it feel even larger than what it really is. She correctly highlights that in such installations, it is the physical space which becomes the artwork itself that instead of being exposed to you is containing and consuming you. So the vastness of both virtual and physical architecture of the space amplify the sensory immersion.

When a large numerical scale is translated into spatial scale in VR, it could also bring about visceral effects. Even before starting this research, I was intrigued by how scale was used in *DeathTolls VR* (Ali Eslami, 2015) to send a poignant message. It sequentially puts you in several creepy locations, in which a massive number of dead bodies are piled up around you. Each location represents a tragic event and the exact number of deaths from a certain war or immigration catastrophe. It spatially visualizes the staggering statistics which we are constantly bombarded with by the news, and have become so numb to what they really mean. Once again, this work demonstrates the educational capacity of VR through embodied understanding of scale.

Scale and Challenge-based Immersion

The second form of immersion in the SCI model is the *challenge-based* which heavily relies on the interactions; It is created as a result of engagement with the challenges that need either or both motor and mental skills to be solved (Ermi & Mäyrä, 2005, P. 45). The question here is in what ways scale could become an interactive/playful parameter and be potentially part of the gameplay mechanics in VR? How could scale bring VR-specific interactions and puzzles?

In the previous chapter, a list of some non-VR games was overviewed in which either scale of the entities or the viewing scale are exploited as part of the interaction mechanic. It was also argued that in FFP games in particular which are closest to VR, scale is barely used as an essential

component of the gameplay. As noted, *Superliminal* and *Dishonored* are among a few exceptions whose gameplay are centered around the *entities' scale* and *viewing scale* respectively. Similarly, Scale in VR could be approached from two different ways: 1st. scale of the surrounding entities (individually), and 2nd. scale of the players' virtual embodiment (or whole surrounding environment). After a brief overview of the first category, I will argue that the second category is where the VR-specific interactions could be mined.

Scale of surrounding entities

Similar to non-VR interactive media, change of scale seems to have a more solid place in VR graphic design software (like Google Tilt Brush or Oculus Quill) than in VR games. I noticed from my personal experience that change of virtual objects' scale in these software becomes as much, if not more useful than their movement and rotation. To work on the detail of an entity, you pick it up and then by moving the controllers away or close while pressing a button, you scale the object up or down. Change of entities' scale per se cannot be considered an original and VR-specific interaction though, and I found it very familiar and intuitive even to those who try VR for the first time. One reason might be the fact that resizing entities like frames and panels on the screen-based interactive mediums has become one of most frequently used actions provided in many graphic user interfaces. Frames could convey additional layers of meaning in a virtual reality space though, precisely due to the *framelessness* of the VR medium. I saw examples of resizable frames in VR platforms like in Windows Mixed Reality (WMR) Portal. You can import as many panels and 2D screens, resize and locate them wherever around you. You can also create your own Virtual IMAX cinema and watch your favorite movies in VR with a similar sensory impact. I have barely encountered examples in which the scale of the frames or any other individual entities somehow contribute to the challenge-based immersion in VR.

In the research-creation project *Liquid Perceptions* (Milieux Immersive Reality Lab, 2019) which I was involved in, using different scales was set as a predefined design constraint. The theme was to critically demonstrate the interconnections between the goals we set and the balance of the marine ecosystem in a multiplayer experience (fig.7). The non-VR players compete above the ocean's surface for fishing more, and the VR player's role is to clean up the mess (growing algae) on the ocean floor (as a result of overfishing) before the situation is irreversible. We placed a

gigantic fish underwater, whose movement (fierce vs calm) is a symbolic representation of the health of the ecosystem. In one of the iterations, we decided to also make its scale reactive; the smaller and closer it gets to the VR player, the more critical the situation is. However, in the playtest sessions, we realized that the players barely notice its scale change as they get so busy with the cleaning mechanic[5]; they couldn't recognize that it is the same fish. By keeping it big and at the distance, the player was more constantly aware of its presence, and they were enjoying the imaginary mood it is bringing to the environment. Actually, characters have a significant contribution to the imaginative mode of immersion and I will focus on how their scale could leverage that contribution after exploring the unique role the *scale of player's virtual embodiment* could play in designing VR-specific interactions.

Fig 7. Liquid Perceptions (Milieux Immersive Reality Lab, 2019) | We experimented with different physical interfaces like horizontal and vertical touch screens as well as hand trackers for the fishing mechanic on the non-VR side. In the final iteration, it is the pollution of the growing algae, darkness of the environment and the distance of the fish that indicates how bad the situation is underwater (VR side).

[5] We used different mechanics for cleaning the ocean floor, like gazing at the growing seaweeds or shooting them with a light beam from the controller.

Scale of the player's virtual embodiment

As mentioned in the previous chapter, it is the viewing scale in the non-VR FPP games that makes the player feel like they are small or big. Due to the altered perceptual cues of depth and scale in VR, *viewing scale* becomes equivalent to the *player's scale of virtual embodiment*. The "framelessness" and "virtual IPD" in particular let us have an embodied experience of being small or big. Many of the successful VR experiences are just about embodying different beings of various sizes. I will start with less interactive ones.

In the Eyes of the Animal (2015) and *Tree* (2017) by MIT Documentary Lab are the two examples of this kind which I was able to try at Phi Center. In the former one, you embody a dragonfly, a frog and an owl and get a glimpse of how other species sense their surroundings in different heights of the forest. It has a mesmerizing point-cloud visual style and particles react to your hands colliding with them. In the latter one, you embody a rainforest tree in a photo-realistic environment and experience its growth from a seed to a towering plant. You can only look around and move your branches by swinging your arms while you grow, but you don't have any control over your height which increases gradually. This was making some visitors unsteady and wanting to sit even though it was meant to be a standing experience. Interactions are minimal in both, and that is in harmony with their central theme which is to bring you closer to nature and let you contemplate in a solitary/meditative experience.

There are also multiplayer room-scale VR experiences which transform you into different creatures, but also start to have characteristics of a game. *Life of Us* (Chris Milk & Aaron Koblin, 2017), *Chorus* (Tyler Hurd, 2018) and *Flock* (Object Normal & Holojam, 2016) allow up to four, six and thirty players respectively. None of them contain solid challenges or puzzles but they all take the scale into their playful advantage. In *Life of Us,* you and other players embark on an evolution from a single-cell organism into a cyborg. The interesting part is that you can talk to each other and your voice is altered according to your current scale and state. Change of the scale and appearance happens simultaneously for all the players. But in *Chorus* each player becomes one of the six female warriors, each with its own unique design and scale. You are sent off on a

musical journey in a fantasy world battling with giant beasts. The interesting part is that when you are choosing your character/avatar at the beginning in front of a mirror, their scale is not yet revealed to you. It is very surprising to notice your size differences only when the experience starts. Another surprise is the epic-size of a non-playable tiger who also follows you in the journey. In *Flocks*, all the players embody an abstract round-shape bird which occupies a larger radius than a human physical body. This however, does not prevent players from hitting into each other occasionally, and this is part of the fun. All you have to do is to move around and eat/hit the bugs around you. Scale could have had a more vital role if for instance eating made the players bigger.

Scale of the virtual embodiment in the aforementioned examples is still something static and none of them really utilize the potentials of scale as a dynamic interaction mechanic. *Worlds in Worlds* (2016) by Goro Fujita is not a game but a 3D artwork which proves the potentials of a dynamic scale. It is sculpted with Quill (VR painting software) and has a painterly look. There is a diorama of a fantasy planet in front of you and by using both controllers (like in Tilt Brush) you can scale yourself down into a smaller world crafted on a corner and go on like this repetitively into smaller worlds. It gives you the impression of an infinite scalable canvas. The dioramic style of staging is getting increasingly popular and has started to be a VR genre on its own. You embody a larger-than-life character and interact with a miniature place and its tiny characters. *GiantCop: Justice Above All* (Other Ocean Interactive, 2017), *Down the Rabbit Hole* (Cortopia Studios, 2019), *The Curious Tale of the Stolen Pets* (Fast Travel Games, 2019) are among the successful VR games of this genre. Although scale in these games is a central visual theme, the game challenges are not about it really. Unlike *Worlds in Worlds,* scale in these games is not an interactive parameter either. It puts the player in a rather imaginary engagement with the surrounding environment and characters. This kind of engagement is at the heart of the next mode of immersion which will be covered in the next section.

A Fisherman's Tale (InnerspaceVR, 2018) is one of the few exceptional VR games which exploits scale as an interactive element central to the gameplay (fig.8). You notice that there is a diorama of a room right in front of you. When its roof is removed, you notice that it is the maquette of the same room you are in with the tiny duplicate of your own avatar which is mirroring your movements. When you look up, you realize that there is also a giant duplicate of you above. It

reminds me of the short film *Room 8* (James Griffiths, 2013) which is exactly based on the same concept. You are put in interaction with a smaller/bigger version of yourself and your environment in multiple views. Puzzles of this game revolve around figuring out how to make pieces small and big so that they could fit into their right places. Taking objects from your surrounding space and putting them inside the smaller room, or throwing them out into the bigger room makes them get bigger and smaller respectively.

Fig 8. Fisherman's Tale (InnerspaceVR, 2018) | Uniqueness of this game is not only owing to the change of objects' scale, but to the player's active evaluation of their own scale by being confronted with smaller and larger avatars of themselves. Image retrieved from afishermanstale-game.com

Another great example which I more recently came across was the online VR game *Half + Half* (Normalvr, 2020). There are eight gates in the open entrance lobby in which you start the game, and each would take you into a different game. One of them is the hide-and-seek game which takes place in an open playground covered with a bunch of play structures. The players are divided randomly into hiders and seekers whose scale turns into very small and very big respectively and in a swift transition. The very same space which appears to small hiders like a neighborhood of puzzling and colorful buildings, appears to giant seekers only like a big maquette.

The key to build such unique-to-VR experiences is to make the scale dynamic and let the player experience one single environment through different scales and vantage points. Other than games, I found inspiring examples of museum-like VR experiences which treated the diorama of the space

like a main menu, and as a method of guiding the visitors and preventing them from getting lost in the space. *Virtual Bauhaus* (Goethe-Institut, 2019) and *Museum of Other Realities* (MOR Museum Inc., 2020) are good examples. By aiming at different spots on the miniature using the controller, you will be teleported to different corners of the space. In *MOR*, you are also given the option of choosing from three different scales of embodiment at any time. By taking the controller close to one side of the headset while pressing a certain button, one of the three magic bottles appears in front of you. Each bottle is filled with a liquid of a certain color representing one of the three possible scales. By taking the chosen bottle close to the headset (like drinking), your scale is changed immediately. Although it doesn't seem to be a very instrumental mechanic, it adds significantly to the richness of the experience by just allowing visitors to walk through the same museum space in various scales.

Experiment 2: Gates | Multiple Scales of Embodiment

The thought behind my second experiment was to let the player interactively change their own size and experience the same scene through multiple scales. The objective was not to design a challenge but it was to go beyond the sensory immersion and start toying with scale of embodiment as an interactive element. It started with creating a desert-like scene in Unity which was then covered with a gigantic open structure consisting of several inclined columns (fig.9_Top). I scaled a duplicate of the same structure down and placed it on a tiny area of the desert. It was under this inner structure where the player was spawned at the beginning with the default scale. Then I imported four random but well-known historical sculptures from the Sketchfab online 3D library and placed them on four sides of the inner area. Four gates were placed on each side, facing towards the sculptures (fig.9_Bottom).

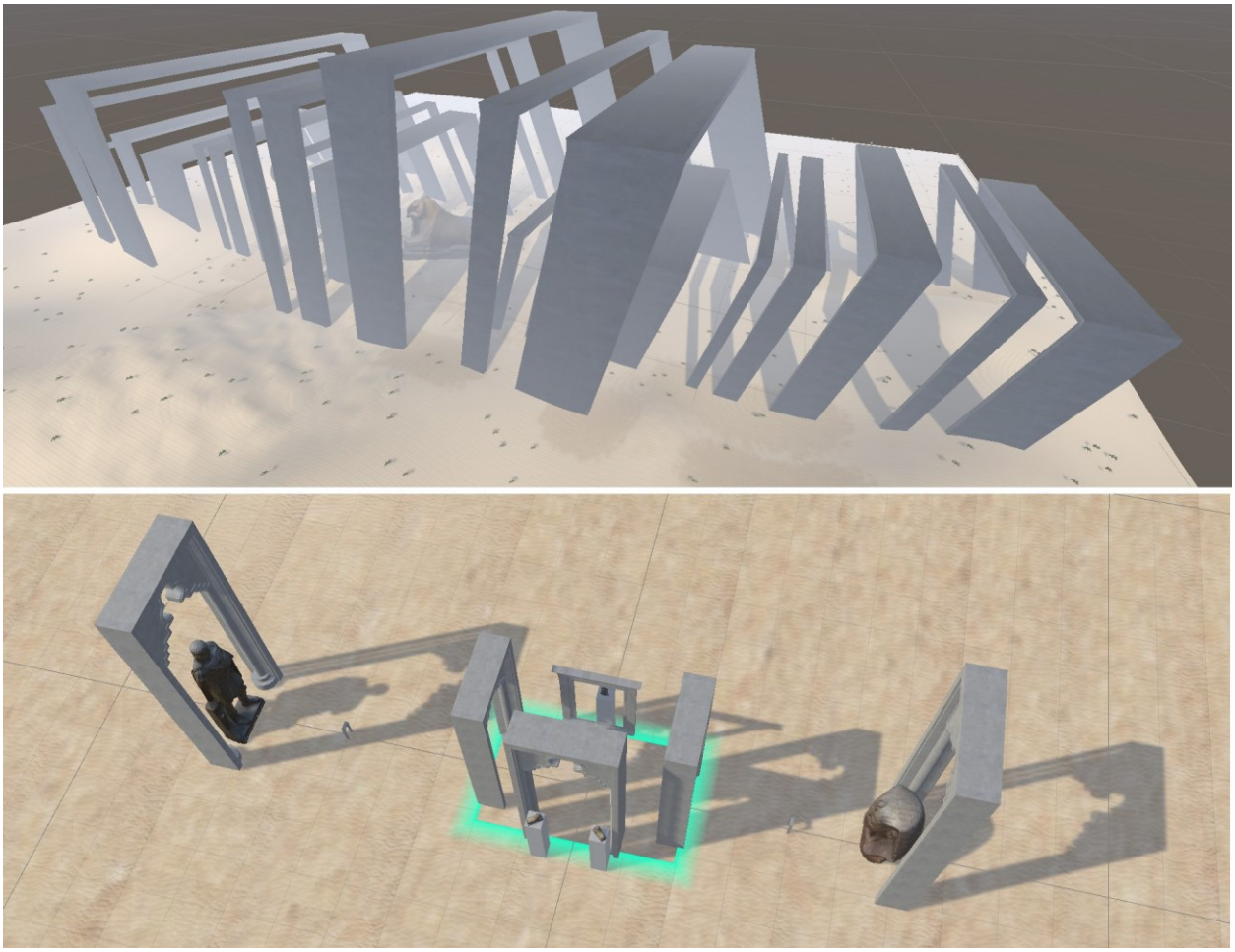

Fig 9. Experiment 2: Gates (Structure) | Top: overarching outer structure which is visible through the surrounding columns of the small room. Bottom: boundary of the play area at default scale is highlighted. I decided to remove the duplicated inner structure at this point, as it was interfering with four gates that were now enough to define the boundaries of the small room.

I enlarged two of the sculptures into massive scales and placed them in distance and kept the other two as tall as the player and much closer. The idea was to make the gates behave like portals; by stepping in the ones that are facing towards the giant/distant sculptures you get as big and teleported next to them. By entering those facing towards the standard sized sculptures, you get tiny and teleported beneath them which now appear so gigantic. (fig.10) To be able to return back to the original spot/scale I also placed four returning gates each positioned just a few steps behind the teleported spots and as big as the player's current size. I also put the miniature duplicates of these giant sculptures next to their corresponding entry gates. It was to punctuate the relativity of the sculptures' scale in relation to the player's size.

Fig 10. Experiment 2: Gates (Mechanic) | Left: when you are 30 times bigger. By stepping back into the large gate, you return back to the default size. Right: when you are 10 times smaller and teleported beneath the sculpture which is only 2.5m tall when you are in default scale.

The first thing I learned through the feedback I received from the colleagues and faculty was that the change of one's scale is not always easily recognizable. It is perhaps because it is a much less familiar experience than change of entities' scale which as mentioned has been a common operation in graphic design software[6]. One solution is to place some perceptual cues in the scene. I populated the desert with palm trees and it was convincing. I also added audio cues; the sound pitch/duration of the ambient music and sound effects gets lower/slower when the player gets big, and vice versa when they get small. The initial scale of the player through which they are spawned in the scene matters as it will presumably be perceived as their default/original scale. Another idea to punctuate the change of scale was to make the scale animation visible instead of masking it behind a fade-to-black dissolve that was the case in this experiment. I tested that in the last prototype which will be covered in the next chapter with other sorts of issues that were raised implementing the idea of gates/portals in general.

[6] It is perhaps for the same reason that they decided to include a scale bar in TiltBrush's GUI which appears when you are changing not entities' but your own scale. It depicts a range of symbolic figures from a rat to a dinosaur and tells which one of them your current scale is.

Scale and Imaginative Immersion

This mode of immersion mainly relies on the imaginary relationship with the virtual world and empathetic engagement with its characters and their stories (Ermi & Mäyrä, 2005). It has similarities to what is known as *suspension of disbelief,* which is a common term used in cinema and linear storytelling[7]. Perhaps that is why the imaginative immersion is directly shared with those who are only watching and not playing the game, similar to watching a film. Strong sensory immersion could advance the suspension of disbelief, but it doesn't guarantee a sustainable imaginative immersion.

Ermi and Mäyrä identify "Characters", "Worlds" and "Stories" as the key elements of this type of immersion, and I chose to focus on the first one. Character is arguably the strongest element which contributes to the storyline and causal chain, but it is also a formal element which allows investigation of scale. My aim is to explore how various scales of the character in VR could affect our emotional responses in different contexts. By that, I mean different levels of agency and interactivity of the characters which affects how we interpret their scales and engage with them. Are they static or moving characters? if moving, are they interactive too? player or non-player? how much of their movements is live and generative (driven by the player, AI-backed algorithm or live acting), and how much of it is pre-recorded (pre-animated or performance-captured)? Premised on these questions I will cover the following case-studies in three contexts, namely: *Static Characters in Spatial Narratives, Moving Characters in Linear Narratives* and *Player/non-Player Characters in Interactive Narratives*. My main focus will be on the second one (Cinematic VR examples), because it is where the imaginative immersion usually dominates the other modes. In that section, I will specifically explore the possibility of adapting the cinematic shot-framings in VR, in the absence of the frame.

Static Characters in Spatial Narratives

Exaggeration and manipulation of scale for even merely static characters could deepen the imaginative immersion, as it amplifies the surrealism and fictitious aspect of the atmosphere. I am referring to spatially-dominant narratives (like in a museum) that are not as linear as a film and not

[7] It is when the audience intentionally switches their rational/critical thinking off in order to get emotionally engaged with the fiction and create empathy with its characters ("Suspension of Disbelief," 2020)

as interactive as a game. Life-like but not life-size works of the contemporary sculptor Ron Mueck are perhaps the best examples of how manipulation of the character's scale could incite emotions in a spatial experience (fig.11). I don't recall any VR content of static photo-realistic characters with different sizes, but it is quite plausible to imagine how effective translation of Muek's works would be in VR. His meticulous attention to details in his hyperrealist approach clearly enhance the sensory and emotional stimulation.

Fig 11. Ron Mueck's hyper-realistic sculptures | Left: less than 1m size Spooning Couple (2005), Right: approx. 5m Boy (1999). Images retrieved from: theatlantic.com/photo/2013/10/the-hyperrealistic-sculptures-of-ron-mueck/100606

Patina Lee in her article *Oversized Art: Is Bigger Really Better?* (2017) considers the engagement with oversized artworks related to the reference they make to an original and standard sized version. Tweaking just one parameter [i.e. scale] of a realistic representation of something [ex: a character] from the real world could create strange and sometimes uncanny experiences; and it is the result of convergence of the familiar with the unfamiliar (ibid). It seems that the magically poignant feeling about most of his works relies on the contradictory use of scale, very much like the contrapuntal technique in composing film score[8]. Scales of his figures contradict their gestures and facial expressions; the bigger they are the more vulnerable and intimidated they seem to be.

Inspired by his works I did a similar experiment in VR. I chose the most familiar object to myself, my own body to be replicated in front of me in three different scales and gestures. To reach a similar level of detail as in Mueck's works I used the photogrammetry technique to scan myself

[8] Contrapuntal scoring is the juxtaposition of a footage with a music score which carries a totally opposite emotion in order to elicit a unique and enhanced type of emotion *(Beller, 2011)*.

using a cellphone camera and generate the 3D mesh via Meshroom software. I then exported the high-poly models to Blender and optimized them, which didn't turn out so polished. Imported into unity, I started scaling and arranging all three models in one scene (fig.12).

Fig 12. Self Portrait Photogrammetry | Left (default size): neutral pose and looking straight, Middle (small size): lying relaxed on the floor looking up. Right (big size): sitting on the sofa, embracing my knees and looking down.

They all felt to me like papier-mâché sculptures at first glance, apparently for the lack of detail and movement. But surprisingly, it was my default scale body which provoked the most peculiar feeling. I have not experienced walking around a mummified myself previously, and perhaps no other medium is able to simulate such a literally out of body experience. The thing I clearly noticed was that I have a misperception of my own size in reality, and realized that my body occupies a larger physical space than what I thought.

Moving characters in Linear Narratives (Cinematic VR)

When the character starts to move in a linear narrative and cinematic context, temporal elements which affect the pace of experience (ex: performance of the character) come to have equally significant effects as the static elements (ex: visual appearance of the character) in shaping our imaginative immersion. In other words, the *temporal scale* contributes as much, if not more than *spatial scale* to this mode of immersion. In non-VR screen-based mediums, the camera partakes vitally in shaping not only the spatial but also temporal scale of the experience. The camera, especially in the linear narratives, is not only a window to the fictional world but is actually an invisible moving character whose performance heavily influences the way we engage with other characters. In VR, the frame is shattered and hence the camera is no more a separate entity from the spectator. In spite of that, my main discussion in this section is how the camera performance

could be translated into VR; Is it possible to adapt the cinematic conventions of viewing and framing using just the scale differences between the viewer and the moving character?

Translation of the Camera Performance in VR

The camera performance is composed of attributes like *cuts and transitions* through the process of editing, and *shot-framing* through the optical behaviour of the lens. Cuts and transitions usually convey the passage of time in cinema. In VR, cuts are typically interpreted as a spatial phenomenon and perceived as displacement of the player in VR. That is why cutting is not as freely used even in 360 cinematic experiences, as it could easily result in disorientation and discomfort of the viewer. *Pearl* (Google Spotlight Stories, 2016) is one of the successful exceptions. Despite it being full of ongoing cuts, you never confuse them with teleportation, as you are situated on the front passenger seat of a car throughout the entire experience and the viewing angle is never intercepted by these cuts.

Shot-framing in cinema is a compositional attribute which defines in what size and from what angle the character is depicted within the frame. Technically speaking, shot-framing is a combination of *viewing scale* and *viewing angle*. As mentioned earlier, the viewing scale or cinematically known as the *field size* could range from the extreme close-up to extreme long-shot of the character. Viewing angle ranges from low-angle to eye-level and then to high-angle shots. Since Field of View (FOV) is something fixed and given in VR, there is no zooming operation to achieve these shots and angles. Instead, the combination of our *scale of virtual embodiment* and our *distance* from the characters could be applied, noting that our distance from the characters is also affected by how big they are. The question is if/how the scale differences in VR could convey similar emotions and meanings that shot-framings do effectively in cinema.

As an example, close-up shots are known for psychologically bringing the subject closer and raising empathy with them. However, Mike Seymour in *8i-Putting People Front and Center VR* (2015) correctly affirms that approaching the holographic capture of the humans in VR while performing is totally different than watching them in a large close-up shot on a flat screen. It feels like you are intruding into their private space. He refers to Ashley Martin Scott who recorded herself with 8i's volumetric capture technology while holding her baby and leaving her a message

for the future. She couldn't stop crying in the headset afterwards, not from a strong empathy with the character, but from being able to vividly live a memory; by stepping back into her own body and watching her baby at a passed certain age (Lauren Goode, 2017).

Dear Angelica (Oculus Story Studio, 2017) is still the best example I can remember from the linear narratives in VR in which scale is exploited like shot-framing to convey different emotions (fig.13). It is about a young girl named Jessica who is writing a letter to her late mother Angelica (a movie star) while dreaming of her acting in her roles. You first find yourself in Jessica's room and see her in standard human scale. I found this *landing scale* important in helping recognize that the exaggerated scales in the following sequences are merely a form of expression, and prevents you from confusing that it is a story of dwarfs or giants (fig.13_Right). Later you witness the battle of Angelica with a huge dragon from different angles and scales in the epic climax of the story. That is followed by an emotional sequence where she is lying on a hospital bed with Jessica standing next to her; but this time they are illustrated in a tiny scale and positioned much lower than your eye level which strongly expresses the illness of the mother and vulnerability of the daughter. The point is that the scale of the characters in this work is never misperceived as part of their appearance quality; it is the whole virtual world, or equivalently correct to say that it is the viewer's scale that is changing.

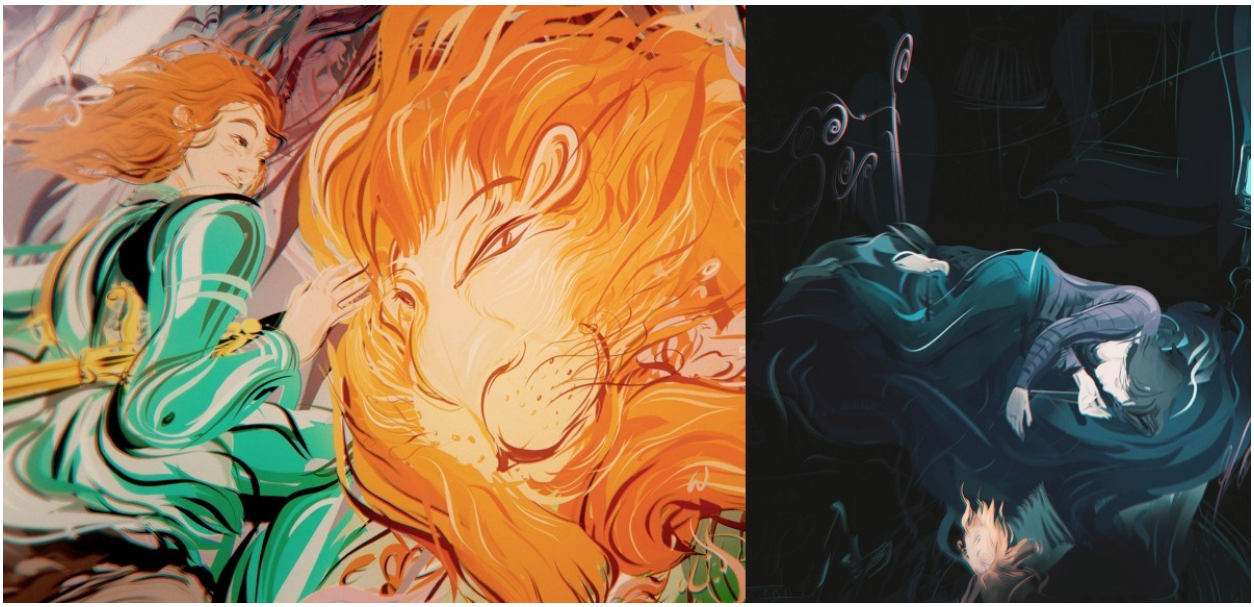

Fig 13. Dear Angelica (Oculus Story Studio, 2017) | Fantastic visual style and music score of this work amplifies the emotions elicited by the scale. Right: you are spawned in Jessica's room on a human scale. Images retrieved from: vrscout.com/news/dear-angelica-will-make-you-believe-in-vr-storytelling/

I was curious to see how my reactions would be when encountering the humanoid 3D character of the short animation *Light Sight* (2016) in different scales. I had created that film as part of another research-creation in the context of linear storytelling and for the flat-screen medium. So that was giving me access to the needed assets. The story revolves around performance of one character which goes through a range of emotions. One of my attempts in that film was to magnify the feelings with the use of appropriate shot-framings and camera angles. For this experiment, I selected three parts of the film in which the character is in three distinct emotional statuses: a) curious and wondered, b) arrogant and thrilled, c) broken and sad. The following shot angles/framings were used in the film for each of these parts respectively: eye-level (medium/full-shot), low-angle (long-shot), high-angle (close-up). These parts were imported into Unity in FBX file format and in three different scenes of three various scales (fig.14).

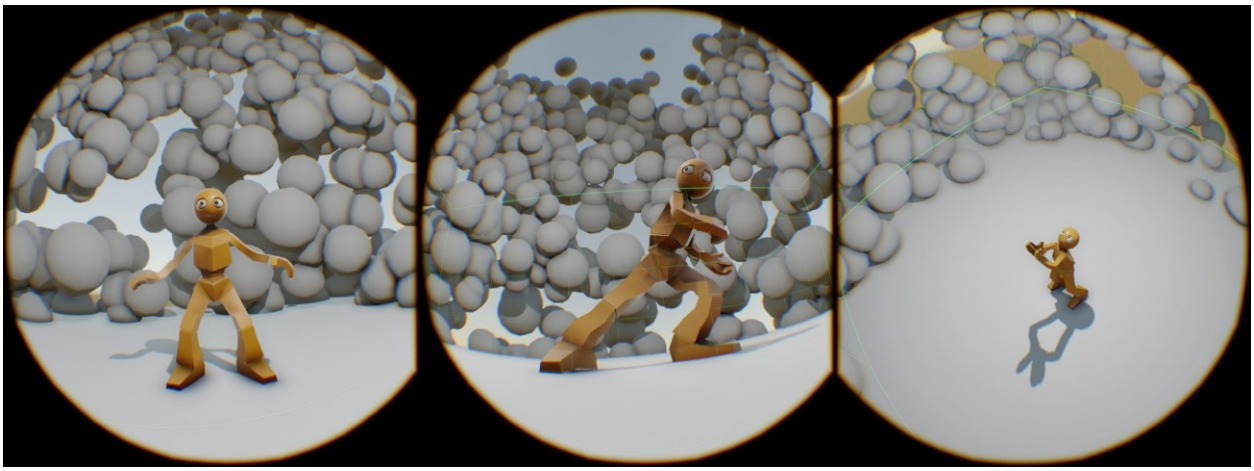

Fig 14. Experiment 3 (Light Sight in VR) | Left: approximately equal size with the character, Middle: character is almost 50 times bigger than the viewer, Right: viewer is almost 6 times bigger than the character.

In the first scenario where the character has a similar size as yours, it feels like your engagement with them is more cognitive rather than emotional; as if you are occupying the same space with similar power dynamics and are ready to start a dialogue. This could feel physically intimate and hence easily uncomfortable. That was the response I also witnessed from a few people who tried it; "oh he's looking at me!" and some even stepped back a bit. Adding a slight responsiveness to the character in this scale/viewing angle would take the engagement with them to a whole new level, making it feel like you are in a live theatre rather than watching a pre-recorded performance. *Henry* (Oculus Story Studio, 2015) is a classic example in which the character is just looking at you while performing. Timing of the character performance in *Piggy* (Google Spotlight Stories,

2018) is affected by where you are looking at. Lucy in *Wolves in the Walls* (2019) by Fable Studio is not only aware of your presence but also interacts with you occasionally. She is described in Fable's website as a virtual being whose performance is backed by AI.

In the second scenario where the character is roughly six times smaller than you, a strong feel of pathos and care was provoked. You are given a dominant view and power over the character and I found this size relationship functioning very much like a close-up shot in cinema. This is especially effective for emotional stories. *The Rose and I* (2016) by Penrose Studios has been one of the very first non-interactive stories I experienced in VR at this scale. It has a low-poly aesthetics with a smooth and polished animation. There is no specific plot though; you just walk around a lonely cute character on a small floating planet on your eye-level who makes friends with a rose. Their next VR piece with the same size relationship is *Allumette* (2016) which has a more fleshed-out story and this time with a stop-motion look animation. The story is inspired by Hans Christian Andersen's sad story *The Little Match Girl* (1845). This work proves how effective dioramic staging is, in psychologically bringing the characters closer and narrating emotional stories. Actually, I found the dioramic scenography to be facilitating the imaginative mode of immersion in VR stronger than in any other scenarios. As mentioned earlier it has started to become a genre on its own in both interactive and non-interactive VRs.

In the last scenario of this experiment, you are almost fifty times smaller than the character who is arrogantly jumping around. Unlike the previous cases, your proximity to the large-scale character has a way more significant effect on how big you perceive them. To avoid the need for a long-way travel to see these differences, I added a very slow dolly movement to the camera position which takes the player from a corner of the room (that is also enlarged) to right below the character's feet. I found this scale relationship behaving very much like a long-shot when the big character is far enough, as it similarly encourages you to look around and see the character in relation to its surroundings. But it never feels like a close-up shot even when you are so close to the character. In fact, the sensory and visceral impact surpasses the imaginative engagement. "I'm about to be smashed under his huge feet!" is a typical comment.

The central theme of several non-interactive experiences which came early to demonstrate the uniqueness of VR were all about putting you in front of a giant creature. *Jurassic World: Apatosaurus* (Felix & Paul Studios, 2015) is a classic cinematic VR example in which a giant dinosaur wakes up, leans forward and comes face to face with you. In *theBlue* (Wevr, 2016) you are under the ocean on the deck of a sunken ship when a huge whale approaches you and looks straight into your eyes. *Lost* (Oculus Story Studio, 2016) puts you in direct contact with the giant robot character of the classic animation *The Iron Giant* (Brad Bird, 1999). None of these works puts the small spectator in relation to not only the giants but also to the normal-sized characters. In other words, such scale difference is not employed as a form of cinematic expression akin to how shot-framing operates. Perhaps for that to be accepted comfortably by both the audience and the author as a form of communication, the sensory impact needs to be softened a bit, and this eventually happens if people start to get used to the medium.

Player/Non-Player characters in Interactive Narratives (VR Games)

The imaginative mode of immersion goes hand in hand with the challenge-based one, especially in games where the progress of the narrative relies on our agency as the players and the objectives that we pursue. Regardless of how big or small they look, the imaginative engagement with a Player Character (PC) and Non-Player Character (NPC) in a game is not precisely the same as with a non-interactive character in a linear cinematic narrative. In the interactive context, the illusion of character's aliveness is also affected by the quality of their real-time responsiveness. In VR games, because of the fact the player is always situated in the character's world, interaction with PC and NPCs has some unique differences with non-VR games.

Moss (Polyarc, 2018) is an exceptional VR game in which you emotionally engage with a tiny little character in a puzzle platform game setting. Besides the mesmerizing design of the dioramic world, it is the special connections you make with the player character that immerse you imaginatively. You are given the role of the *Reader* with a masked face avatar who can see his reflection on the river's surface beneath. You interact with the environment, but simultaneously and with the other controller you move a little anthropomorphized mouse named *Quill;* that is why this game is also described as a blend of first-person and third-person perspectives (fig.15). Aside from its gorgeous animations when you are moving her, it is the authenticity of her performance

when you don't control her that makes you recognize her as a small living creature. You always want to protect her and she is aware of your presence and reacts to your actions; you can pet her and heal her injuries by taking the controller close to her; she looks up and shakes hands for you and greets you with cute gestures. Interestingly, even when you are just controlling her like any other well-animated player character, say Ori in *Ori and the Blind Forest* (Moon Studios, 2015), engagement with *Quill* still feels much more intimate. As if you are requesting rather than forcing her to move. Perhaps it is because being situated in the same virtual world as she is, takes you away from the command and control setup of sitting in front of a screen.

A similar relationship between the player and this time a gigantic non-player character is established in *The Last Guardian VR* (2017) *from* Team Ico*,* which is just a VR demo for the original title. You are the *Boy* who will need assistance from a towering dog-bird character named *Trico* to be able to navigate some areas and solve some puzzles (fig.16). Despite the strong visceral impact that the whole massive architectural scenery imposes in this game, your encounter with *Trico* is not merely a sensory one. This feel of affection comes from the fact that *Trico* is the player's companion across the whole game and not a monstrous boss, and thus it's colossal scale does not function as a threatening feature but an element of trust and safety. Here also you pet and feed *Trico,* and emotional attachment to it seems to be even stronger for those who played the original non-VR game. In addition to its polished animation, its seemingly autonomous behaviours and responsiveness to your presence grants *Trico* the illusion of life. The creator of the original game Fumito Ueda states that, "Trico is driven by its own instincts, and the player must figure out how to harness these to complete the game's puzzles" (*The Last Guardian*, n.d.). The studio is famous for creating games like *Ico* (2001) and *Shadow of the Colossus* (2005) which showcase vast architectural settings and gigantic characters for higher imaginative immersion. VR seems to be a perfect medium for the designers of monumental architectures and huge characters.

Fig 15. (Left). Moss (Polyarc, 2018) | Framelessness of the VR brings you closer to the PC (Quill); the fact that you are playing another role simultaneously (Reader) makes Quill feel like an NPC simultaneously. Image retrieved from: roadtovr.com/moss-psvr-review-the-opening-chapter-of-an-adorable-adventurer/

Fig 16. (Right). The Last Guardian VR (Team Ico, 2017) | massive scale difference between you and Trico does not function as a cinematic vocabulary, but it is not also to evoke visceral reactions only. Image retrieved from: playstation.com/en-gb/games/the-last-guardian-ps4/

To summarize this chapter, VR-specific experiences take into their advantage the particularities of the medium like the absence of the frame and changeable virtual IPD. I discussed that such differences make the perceptual cues of scale and depth more spatial and accurate. This brings about an intensified sensory immersion, but also makes VR a suitable medium for spatial visualizations and simulations of massive scale phenomena. Virtual embodiment is another byproduct of these unique perceptual cues which could facilitate the challenge-based immersion; by making the player's size dynamic and providing interaction with one environment in multiple scales, VR-specific gameplays could be achieved. In the last part, my main focus was on the cinematic VR contents; I mainly argued that the size differences between the experiencer and the characters could have the same function as the shot-framing in cinema and elicit similar emotions. I observed that dioramic staging in VR operates like a close-up shot in bringing characters psychologically closer and stimulating empathy. The visceral effect of facing big characters outweighs the emotional engagement typically. Encountering characters with similar sizes as yours could be uncanny and potentially uncomfortable as it feels more physically intimate. When scale becomes a dynamic attribute, the landing scale matters as it registers the actual size of the characters. Regardless of the characters being static, moving or interactive, the framelessness of the medium puts the experiencer in a closer relationship with the characters that are a vital formal element of the imaginative immersion. Consequently, controlling the player character in a third-person VR game is potentially more empathetic, as they are more likely recognized as independent

living beings rather than an extension of your controller. Also Interacting with NPCs in VR could be more imaginary as you literally step into their imaginary worlds.

Chapter 4 | Remediation of Pardeh-Khani (7Pardeh)

As mentioned in the introduction chapter, the aim of this research-creation was not only to explore and experiment with the affordances of scale in VR. Another goal was to prototype an experience with facets of linear, spatial and interactive narratives which could meaningfully utilize these affordances. As opposed to other experiments, I was more concerned about the narrative content and a solid theme at this stage because my intention was to turn this prototype into a stand-alone experience and make it potentially sharable to a wider range of audience beyond the academic context.

I started to consider Iranian traditional art and culture as the main source of inspiration from the early stages of the research. This was not motivated by a nationalistic interest nor was it merely for the richness of the long history behind that culture. I find this inclination mainly a response to the questions of cultural identity which was especially kindled after my recent migration to Canada where this research was started. I was trying to answer different questions like: what stories am I more comfortable to tell as an Iranian designer/storyteller in a culturally diverse setting? What stories are the local audiences of various cultural backgrounds curious to know about? The thing I knew for sure was that no matter how important the stories of indigenous communities in Canada are, for instance, or how relevant the topic of racial discrimination is in the North American context, I did not find myself comfortable nor eligible to touch upon these issues, at least as a newcomer. Moreover, despite being an Iranian, I am still unfamiliar with plenty of historical/cultural contents from the region and I have been looking for a chance to explore them.

Exploration of Iranian Historical/Cultural Facets

Iranian culture being a very vast ensemble, I had to narrow down the scope of my investigation and respond to questions like: what aspect of the Iranian art and culture are we referring to? what point of time in its long history and what geographical spot in its varying plateau/boundaries? how well could the chosen content benefit from the VR medium-specificities? would it offer any VR-

ready narrative content? how would the outcomes of my case studies and experimentation with scale in VR come to nourish the chosen subject? could scale have any unique contribution to the imaginative, challenge-based and sensory engagement with the chosen narrative?

I started with a broad exploration of different facets and periods of the Iranian art and culture. My initial idea was to approach the spatial, interactive and linear narratives separately and supply them from different sources of inspiration, i.e.:

- Iranian architecture and the social interactions within.
- Literature, paintings, poetry and dramatic arts (including Iranian cinema and music)
- Different historical periods and dynasties, pre and post Islamic resources as well as contemporary history

Soon I decided to focus merely on the architecture for its capacity in encompassing all other forms of art and hosting/shaping different social and cultural activities. When it comes to designing virtual spaces, architecture becomes a vital ingredient especially when the 3D graphics dominate the aesthetics and visual presentation of the space. The significance of the spatial design in 3D games is elaborately explored by Michael Nitsche in the book *Video Game Spaces: Image, Play, and Structures in 3D Worlds* (2008). He compares the abstract space in verbal narrative with literal space of the 3D games in particular, and correctly states that in the context of video games "the creator becomes a *spacemaker* or *narrative architect* and the player an explorer and conqueror of the space" (20).

Nitsche explains the role and significance of space to the sense of *presence*[9] in the virtual worlds at three levels, namely: *personal, social and environmental* presence. According to him, real-time architectural walk-throughs are examples of presence at the personal level, even though the interaction is limited only to spatial navigation. He considers that the effective visual presentation, dramatization of the space and higher level of interactivity enhances this form of presence. Social presence achieved when the space is shared with multiple people in multi-user experiences or when there are sorts of communication with non-player characters. Environmental presence is when the

[9] He describes presence as a subjective feeling of "being present within a video game space as a result of an immersion into the content of the fictional world" (203).

virtual space reacts to the player's interaction and traces of these interactions are left in the environment (205-209).

The spatial design becomes even a more prominent question in VR. From my experience, the first question that the VR player asks intuitively when putting the HMD on is "where am I?" Before asking "what my role is?" Or "who these characters are?" It is worth reminding that one of the primary objectives of the research was to examine how a linear/cinematic narrative could be unraveled in the spatial experience of VR. This objective was pushed aside along the experimentation with scale in previous prototypes. Now the aim was to first choose a traditional architecture, and later design the interactions and integrate a linear story in accordance with the particularities, functions and activities associated with that architecture.

I started to realize that most of the architectures that had grabbed my attention belong to the Safavid era, which is fairly recent in the Persian history (1501-1722). Safavid dynasty is known for its significant cultural impacts on the region even up to this date. There have been many art and architectural accomplishments in this period and Iranian architecture is often identified with the remaining buildings of this period. The architectures I explored that flourished during the safavid empire include: *Khanqah*[10]*, Mosques, Madrasa, Bazaar, Zoorkhaneh*[11]*, Qahveh-Khaneh*

Qahveh-Khaneh (traditional coffeehouse)

Among all candidate architectures I found *Qahveh-Khaneh* (literally translated as [traditional] coffeehouse) the exact place I was looking for. They are believed to appear during the Safavid era. *Qahveh-Khaneh(s)* used to borrow their architectural style and aesthetic features from all other aforementioned buildings. They were not places solely dedicated to drinking tea, coffee or playing board games, but were also meeting places for intellectuals, artists, poets, and government officials. The nature of activities happening in *Qahveh-Khaneh* were diverse, from artistic and social to religious and political; and this makes it a perfect resource for exploration of a variety of narratives. The fact that it used to host the oldest form of dramatic performance in the history of Iran known as *Naqqāli* made this decision even easier. In *Naqqāli* "The performer – the *Naqqāl* –

[10] Place for Sufi rituals and gatherings
[11] Place for traditional form of athletics which is a combination of martial arts and spiritual trainings

recounts stories in verse or prose accompanied by gestures and movements, and sometimes instrumental music and painted scrolls" *(UNESCO - Naqqāli, Iranian Dramatic Story-Telling, n.d.).*

Naqqāli is considered the forefather of the Iranian theatre and dramatic arts which started to lose its popularity as a result of fast pace globalization of the broadcasting media, namely radio and TV, and is now on the verge of extinction. *Naqqāli* was inscribed on UNESCO's List of Intangible Cultural Heritage in Need of Urgent Safeguarding in 2011. All this makes the remediation of this whole ritual even more meaningful as a global matter of concern. One effective way of contributing to the preservation of an intangible heritage with an analogue nature is perhaps converting it or adapting facets of it into a digital media content. This could be considered a step in securing it as an entity of a "digital heritage" which accordingly to UESCO is "made up of computer-based materials of enduring value that should be kept for future generations."; even if they are important enough to be preserved at a group or community level (*Concept of Digital Heritage*, 2019).

It is the versatility of VR in reviving both *Qahveh-Khaneh* and *Naqqāli* that makes it an ideal digital medium for this translation. But before delving into the first prototype of *Qahveh-Khaneh*, I will explain why my focus is on one specific form of *Naqqāli* which is *Pardeh-Khani.*

Pardeh-Khani

Among different forms of *Naqqāli* which were practiced in *Qahveh-Khaneh(s)*, a pictorial form known as Pardeh-Khani (literally translated as reading off curtains/screens) was the most popular one; the *Naqqāl* (reciter/narrator) stands in front of an approximately 5×10 feet *Pardeh* (illustrated curtain usually made of burlap fabric) and tells the stories while acting the painted characters. They draw the audience's attention towards different parts of the *Pardeh* with a cane. It is sometimes the back-and-forth acts and dialogues between *morshed* (experienced *Naqqāl*) and *bache morshed* (assistant performer) that guides the audience's attention. Although Pardeh-Khani was not always performed inside the coffeehouses, it was so tightly associated with it that the style of *Pardeh's* paintings was commonly referred to as "coffeehouse painting style" (Lashkari & Kalantari, 2015).

The contents of the paintings are typically categorized into two main groups; they were either religious/historical (usually about the incident of *Karbala)*, or mythical/epic and mostly taken from *Shahnameh* (Book of Kings). In terms of composition, paintings were sometimes "single frame", depicting only one character or a single event, and this gave them a less narrative and more decorative function. On the other hand, "multi-frame" *Pardehs* had a comic-like layout and were composed of several frames of different sizes which were illustrating multiple events usually about one main character. Frames' borders were sometimes clearly visible but more often blurred and intertwined with other frames. Although traces of interest in naturalism is evident in coffeehouse painting style, it also borrows from the conventions of Persian miniature, one of which is the flatness of the paintings; that is to say, various scales of the figures and frames was to portray the significance of specific characters rather than being a representation of perspective and optical depth (Azizi, 2017).

Pardeh-Khani was overshadowed by the advent of cinema in Iran during the 1900s, and towards the late twentieth century it was almost completely forgotten. One could argue that a colorful and culturally-charged screen was replaced by a neutral silver screen; or in other words, the canvas (technology per se), emancipated from the content, partly for the sake of mass-production, started to be confused with and celebrated as a medium[12]. The pace of such technological colonialism was so fast that it left no time for *Pardeh-Khani* and cultural species alike to adapt. Although there have been sparse attempts to adapt contents of *Pardeh-Khani* like stories of *Shahnameh* in form of animation and video games, I couldn't find any evidence that *Pardh-khani* itself is *remediated* within a new medium or is taking any advantage of the new technologies. I borrowed the term "remediation*"* from Bolter and Grusin (1999) who define it as "the representation of one medium in another" (45), which is a vividly common practice in digital culture. In other words, my goal was not only to adapt the stories which used to be recited in *Pardeh-Khani* but to incorporate and represent *Pardeh-Khani* itself as a content in VR. *Pardeh-Khani* is considered an important cultural heritage to the majority of Iranians regardless of their pre or post Islamic cultural ties. I found it a right narrative choice for this prototype not only for the aforementioned reasons; but to

[12] Although this research has proved me the unique communication affordances of VR as a "medium", I never bought into expressions like "VR is an empathy machine" or "VR will be the next big thing" which seem to be advocating VR for being a magical "tool", independent from how well the narrative content is crafted for it, and what subject it is communicating.

remediate *Pardeh-Khani* in VR is to render a (traditional) screen-based medium into a (cutting-edge) screen-on-your-face medium, and this in itself has been an intriguing inquiry for me.

The capacity of VR to support all the narrative strata that exist in the ritual of *Pardeh-Khani* could make this translation multilayered. *Pardeh-Khani* is a location based experience which involves both interactive and linear narratives. It takes place in *Qahveh-Khaneh*. It is not a fully predetermined performance, and its pace and subject of the stories could be affected by real-time factors such as the average age and gender of the audience and also the improvisations of the *Naqqāl*. Regardless of the spatial compositions of *Pardehs'* illustrations, the stories are typically unraveled in a sequence. Such already existing narrative frameworks provide enough material to start with and there won't be a need to establish them individually and from scratch.

As mentioned before, the significance of the spatial design decisions in any VR experience encouraged me to begin this prototype by concentrating on the architecture of *Qahveh-Khaneh*.

1st Iteration: Typical *Qahveh-Khaneh*

The first step of the prototype was creating a low detail 3D model of a typical *Qahveh-Khaneh* so that I could experience it in VR and evaluate the overall impression of the space and its proportions. After a vast visual exploration, I found a very useful research describing the architectural elements of the places used for traditional performances in Iran by Rahmat Amini, Jalil Kalil Azar and Vahid Moini (2012). The paper begins with the types of *Qahveh-Khaneh* and various forms of *Naqqāli* including *Pardeh-Khani,* and is followed by an overview of the standard architectural features. At the end, a floor and section plan of a typical traditional *Qahveh-Khaneh* with its essential elements is proposed (fig.17).

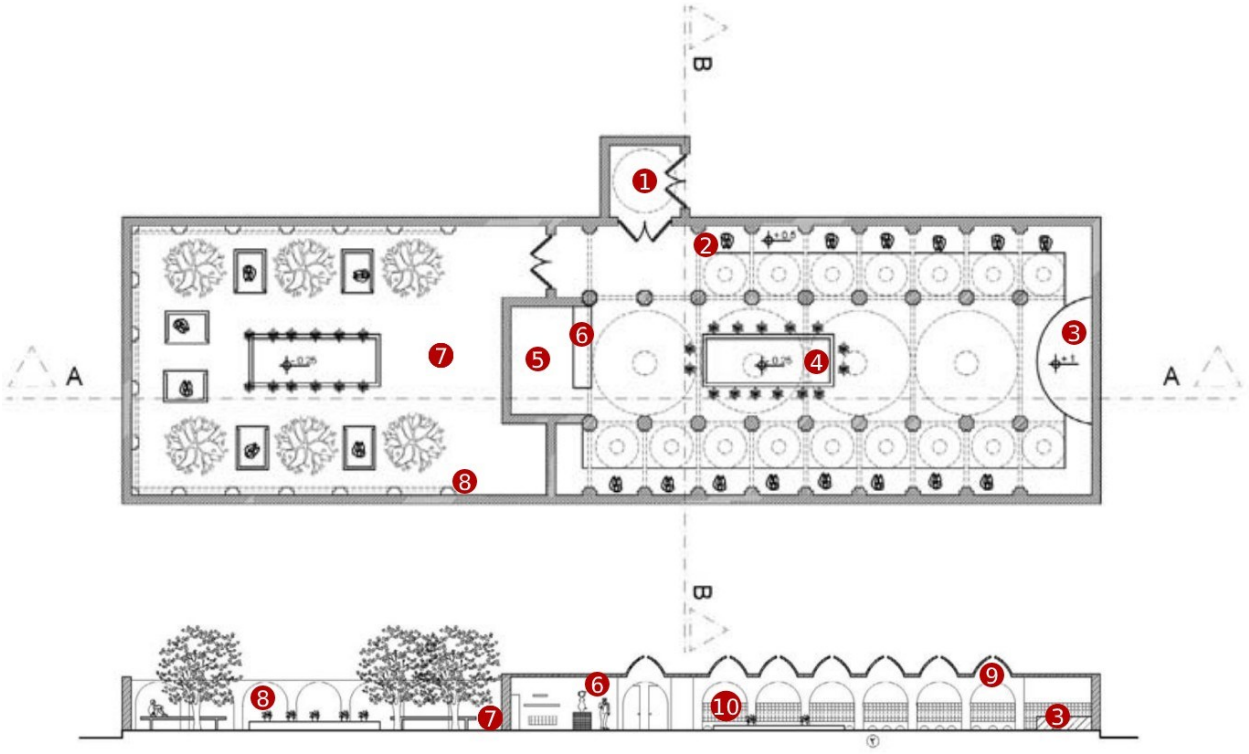

Fig 17. Typical Qahveh-Khaneh Plan | 1) Hashti (porch before the main entry door), 2) Takhts (carpeted benches for the customers), 3) Sardam (a raised platform on which the Naqqāl stands and performs the story), 4) Decorative indoor pools/fountains, 5) Pantry, 6) Reception counter, 7) Small outdoor garden/courtyard, 8) Taqhnamah (arched facade) 9) Skylight, 10) Decorative tile works.

I used this plan as the reference for the first iteration of the prototype (fig.18). SketchUp was used to build the model and then it was imported into Unity. A number of single-frame paintings (as placeholders for the final artworks) were scattered between the columns and behind the dining benches, and also a larger multi-frame painting was placed over the *Sardam* (stage). Then the scene was lit with the natural/sun light and the Global Illumination (GI) was baked. I also added some atmospheric effects like fog which I found especially effective in VR in enhancing the sense of depth in the absence of adjustable depth of field (previous chapter). But it also contributed to the impression of age which perfectly matched with the overall mood.

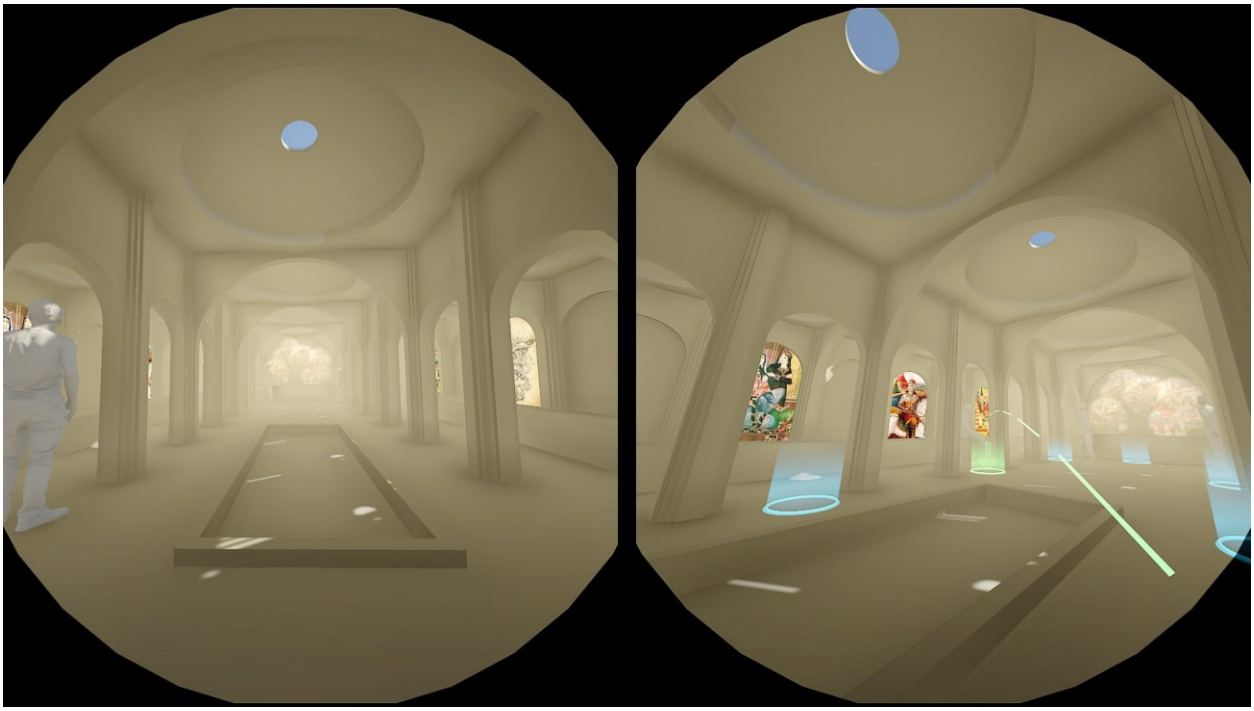

Fig 18. 1st Iteration Qahveh-Khaneh | I did not want to spend time on texturing at least at this stage. Just so as to bring the color scheme of the brickwork which was a common material used in Qahveh-Khaneh(s), a standard shader with a warm diffuse color was assigned to almost everything.

As for the interactivity and navigation, I used the SteamVR SDK and its teleportation mechanics which has become one of the standards of navigation in VR. You simply set predefined points or areas where the player can teleport to. If the player's HMD has six Degrees of Freedom (6DoF[13]), they can also walk within the limitations of the physical room. I placed one teleportation point in front of each *Pardeh* (fig.18_Right) and some other ones near the entrance where the outdoor garden is located. I have explored other types of navigation mechanics for traveling long distances in different VR apps, but found no other method as convenient as teleportation so far. Although I don't get motion sickness easily, choosing alternative ways of movement like gliding over the floor or flying via hand gestures reduces the time I could stay in VR. This factor was even more severe for the majority of the playtesters. Also, the reason why I preferred the teleportation *discrete points* over the teleportation *continuous areas* was to minimize the navigation confusion and make sure no *Pardeh* will be missed by the players; it was also to have a better control over the staging (Mise-En-Scene) of the narrative on each spot.

[13] It means not only their rotational but also translation movements are tracked.

I also began testing a basic logic and motivation behind the navigation. I dimmed the brightness down on the main (multi-frame) *Pardeh* by turning off all the spotlights shooting at different parts of it. They turn on one by one as the player teleports to the points designated to each single-frame *Pardeh*; eventually all the surface of the main *Pardeh* will be illuminated when the whole story is unraveled. The linear story of *Pardeh* was not chosen yet at this stage but an assumption was that each single-frame *Pardeh* will be an info panel of one single character whose role in the story will be elucidated on the main multi-frame *Pardeh*. The spatial mood in this iteration was well received by the colleagues who tested it; lighting, coziness, *Pardeh* illustrations and the curiosity they stimulate, feeling of the virtual fresh air in the backyard were all among the aspects welcomed but the players. I tried to carry them along the next iteration. However, the goal was not just to simply replicate a typical *Qahveh-Khaneh* with an accurate simulation of its features. In fact, the perfect symmetrical layout, predictability of the architectural circulation, modest and monotonous sizes of *Pardeh* do not invite the exaggerated/unreal experience that VR could afford. At this point, I was envisioning three levels for the whole experience, namely: pre-VR (real/physical installation), virtual *Qahveh-Khaneh* (surreal space), and *Pardeh* (fictional/dreamy space).

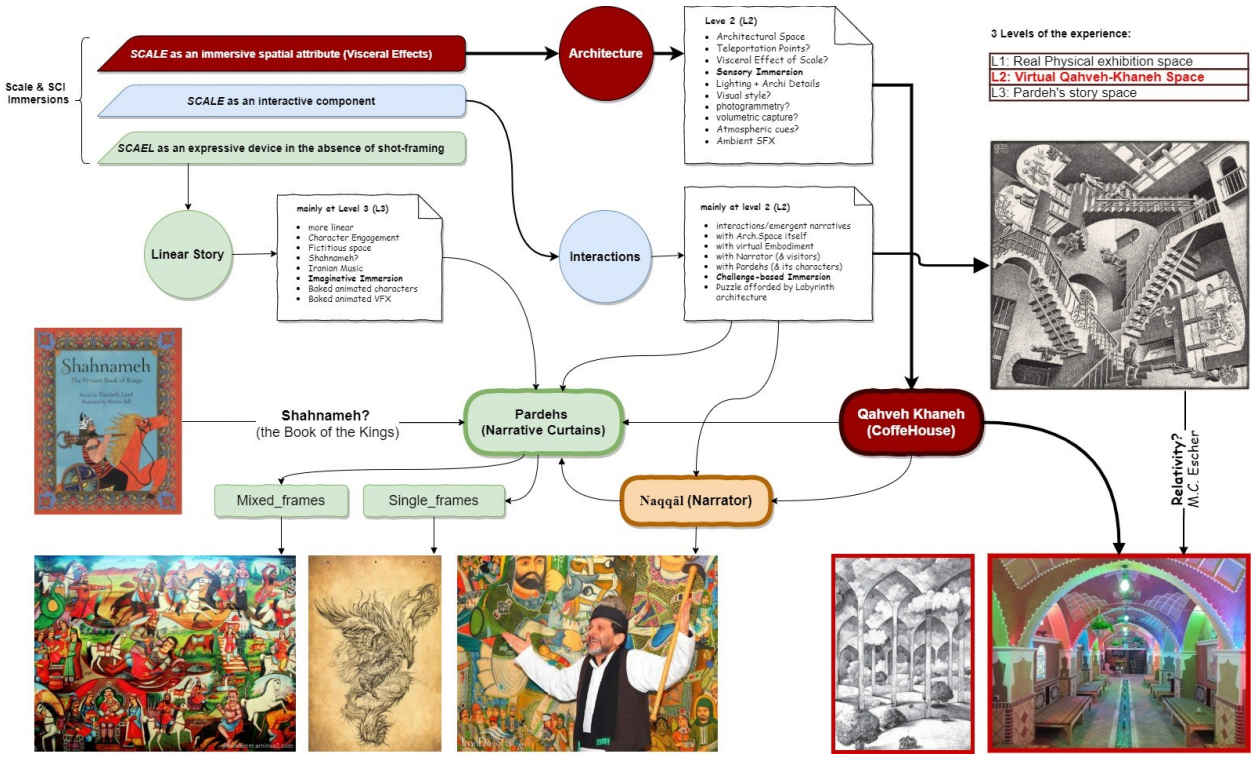

Fig 19. Mind Maps: Experience Levels | To be able to trace the links between the narrative layers/concerns, I started drawing graphs and mind-maps

I was contemplating the possibility of reconciling these levels with the three layers of *Pardeh-Khani* narratives, namely: *Qahveh-Khaneh*, *Naqqāl* and *Pardeh*. On top of this, I have been also attempting to leverage the three modes of immersion (sensory, challenge-based, imaginative) addressed in the previous prototypes with a creative use of scale (fig.19).

The new questions were: first, how the architecture should be revisited in a way that the scale could contribute more strongly to the sensory/spatial as well as interactive/challenge-based narratives. As mentioned, the idea was not just to replicate a typical *Qahveh-Khaneh*, but to appropriate it for narrative particularities that VR could afford. Second question was whether from the abundance of linear stories which used to be recited by the *Naqqāl*, there are any stories that take advantage of scale. A third question was how and if there should be any interaction with *Pardeh*.

M.C. Escher

I have been exploring a diverse range of artworks/styles that could inspire manipulation of *Qahveh-Khaneh* but also correspond to the medium-specificities of VR. The surrealist works had grabbed my attention already; they are essentially about encountering familiar things in unfamiliar settings. Exaggeration/manipulation of scale is an important form of expression in this style. VR is perfectly capable of fulfilling the unreal and subjective quality of a surreal artwork in an actual, explorable architecture. Other than *Dreams of Dali* (Half Full Nelson, Goodby Silverstein and Partners, 2016), I hardly found any VR experience with equally bold reference to this style; the prominent sensation of this experience is when you face those two towering sculptures adapted from *Archeological Reminiscence of Millet's Angelus* (1934) and gigantic elephants from *The Elephants* (1948) at distance. However, it is not really an architectural experience and also the scale is not employed as an interactive component that could contribute to any challenge-based immersion.

I found the works of M.C. Escher and *Relativity* (1953) in particular a key inspiration; most of his works have surreal qualities and many of them like *Relativity* are geometric and architectural as well. At the beginning, *Relativity* just seemed like a perfect liaison; a dreamy *Qahveh-Khaneh* that could bond the cultural story of *Pardeh-Khani* with the narrative affordances of VR. In hindsight,

there are two distinct characteristics which make Escher's works satisfy the objectives of this prototype.

First, Escher was significantly influenced by the aesthetics of Islamic art/architecture and its geometric decorations. Tessellation which allows for an infinite/fractal repetition of patterns is one of the main visual characteristics of many of his works. Tessellation is the core technique used in cuerda-seca[14] that has been a dominant feature of the Iranian architecture especially in the Safavid era. It also found its way to *Qahveh-Khaneh* architectural decorations. In *Relativity,* it is a multiplicity of orientation that generates an interlocking pattern. Affected by Moorish style of architecture, arched gates/roofs are another signature of many of Escher's drawings including the *Relativity*.

Second, Escher's works are full of visual illusions and sometimes depict what is referred to as impossible architecture. Ewan Wilson (2019) in *The Impossible Architecture of Video Games* gives a simple definition of them: "dream-like structures that push spatial logic to its breaking point". Impossible architectures are not plausible to be constructed due to the technological limitations of the time, or because they simply defy the physical laws of space (Wilson, 2019). No matter if they are futuristic or oriented towards the past as Wislon categorizes them, they are usually epic in their scales. He is right in asserting how effective video games are in experimenting with impossible architectures, and this is even more true for VR. Metamorphosis and what we can refer to as impossible transformations are the other features which Escher's illusive drawings are based upon. *Relativity* could be explained as an impossible architecture that hosts impossible transformations. Movement and orientation are intertwined together in a whimsical way, and this justifies the integration of scale as a third parameter of a playful navigation.

Combination of these factors makes *Relativity* an ideal inspiration for creating a labyrinth architecture that welcomes *Pardeh-Khani* and an illusive experience which VR could afford.

[14] Cuerda seca (Spanish for "dry cord") is a technique used when applying coloured glazes to ceramic surfaces. (retrieved from https://en.wikipedia.org/wiki/Cuerda_seca)

2nd Iteration: Escheresque *Qahveh-Khaneh*

I started reproducing *Relativity* in SketchUp. It felt like a cropped drawing of a larger space, so I mirrored the model in all three axes. The result was a symmetrical space consisting of eight repeating parts (fig.20). Then I started breaking the symmetry by adding a slight variety in the openings and doorways on these repeated modules. It already felt huge and complex and created the "wow" effect when tested in VR. Then I bonded all the pieces together by adding larger architectural elements like arched gates of different sizes and bridges of various widths.

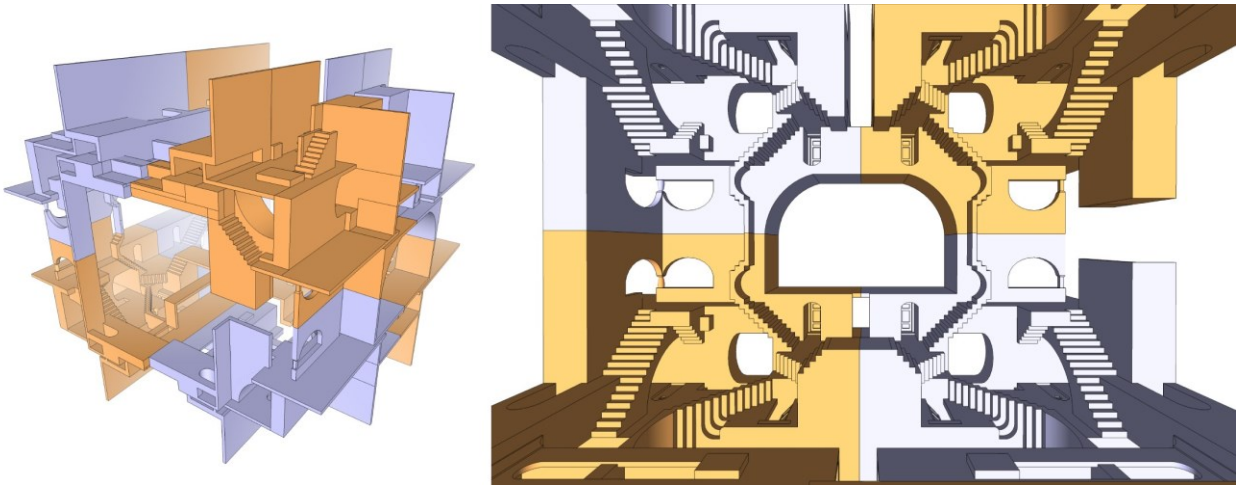

Fig 20. 2nd Iteration (Escheresque Qahveh-Khaneh) | I was constantly rotating the whole space like a Rubik's cube in order to make the placement of added elements architecturally meaningful in different orientations.

I started bringing paintings (placeholders) from the previous iteration into this model. Disabling the shadow cast on the paintings let the sunlight enter from all the surrounding openings and generate interesting lighting patterns after being intercepted by multiple layers of architectural elements. This as a result has yielded the sensory immersion and was the first thing appreciated by the playtesters (fig.21). Next I added some dining benches on different locations. I noticed later that a bench and a dining table is also depicted in *Relativity* which makes its space feel functionally closer to *Qahveh-Khaneh*. To revive the mood of *Qahveh-Khaneh* even further, I started adding motifs from Iranian/Islamic geometric patterns to the handrails. Pointed arches were iconic in the Iranian architecture and I used them especially for the largest gates at the center. I also added *Siyah Masqh* which is an Iranian style of calligraphy around these central arches. Since the player inhabits different scales of embodiment at different points of time, such details also act as scale cues and help the players better understand their current size relative to their surrounding architecture (fig.22).

Fig 21. Escheresque Qahveh-Khaneh (Without Details) | The new space offers significantly more spots/openings for placing paintings with a large variety of sizes in all orientations and on all the floors.

Fig 22. Escheresque Qahveh-Khaneh (Architectural Details) | I did not anticipate how effective handrails will be in mitigating the fear of height particularly around the narrow bridges on the higher levels, and especially for those with more intense visual height intolerance.

Despite that, there have been comments in different playtest sessions regarding the dominance of Escheresque over *Qahveh-Khaneh* aesthetics. For some, it feels like a meditative/cathedral-like space. One reason might be the absence of any texture except for the *Pardeh* illustrations. But this was an intentional design decision in order to enhance the visual contrast and bring attention to the illustrated curtains so that finding them becomes easier for the player. Also the fact that the textures will be seen in different scales would require additional technical considerations; perhaps a

dynamic texture resolution corresponding to different scales and distances of the player. There are features that I have already considered but not implemented yet which help revive the mood of traditional *Qahveh-Khaneh*; these include but not limited to: Indoor pools in different orientations, outdoor gardens that will be terraces in this prototype, limited touches of textures like *Kashi-Kari* (tilework) and brickwork around *Pardeh(s)*, and Persian carpets which used to cover the benches. Another critique was that the space felt static at this stage and could feel more alive if there were animated visuals. I found even the flickering glitches on the shadow edges helps. Adding a slight wind effect to the pool, particles, curtains, plants, as well as adding animated crowd and ambient sounds could all bring life to the space but they have not been the priorities of this iteration.

Navigation mechanics

Deciding for a proper locomotion style and refining the navigation mechanic was a main concern in this prototype. Aside from the fact that locomotion in VR is still a challenging topic, the spatial characteristics of this project brings some additional challenges. Since the target audience of this prototype are not only youngsters and/or gamers, I have been looking for a locomotion method convenient to even first-time users of VR. It would have been ideal to be able to walk around and navigate all the space by foot in a physical space as big as the virtual one. However, the existence of all those levels/staircases as well as the changeable scale and orientation make this replication ironic; as this would mean construction of an impossible architecture on a one-to-one scale.

Recently I came across the article “Literature review of locomotion techniques in virtual reality” (Cherni et al., 2020) in which 22 types of locomotion methods in VR are explored. I don’t intend to go through all of them but to simplify, they could all be located on a single spectrum from the most natural, which is to walk around physically, to the most unnatural, which is to teleport. Walking around gives the player a continuous update of its coordination whereas in the teleportation player's movement is discrete and usually requires least physical effort. In the middle of the spectrum fall methods which call for some sort of movement-in-place (like Arm Swinging) using joystick or more sophisticated peripherals (like omnidirectional treadmills). At the end of this article, they propose a comparative table where all these styles of locomotion are rated according to a number of criteria, namely: “the presence in the virtual environment (i.e., immersion sensation), ease of use, control precision, spatial orientation, self-motion sensation (i.e., sensation

of controlling the movement), tiredness, motion sickness, adaptation for large virtual environments and adaptation for virtual reality interaction" (Cherni et al, 2020). *Physical movement* and *teleportation* have the highest scores in this table respectively. A combination of these two has created the core mechanics of navigation in this prototype for the exact same factors, even though I have also been experimenting with the controller's input for the scale-change mechanics in some iterations.

Clara Fernández-Vara in *Labyrinth and Maze: Video Game Navigation Challenges* (2007) tries to distinguish a maze from s labyrinth and subcategorize it as a form of it; as opposed to classic labyrinths whose purpose is only to stretch the distance and consequently delay and direct the traversal, mazes are more complex as they are multicursal containing branching paths. As such, mazes are more welcomed in game design as "navigating them already constitutes a challenge which can be further amplified by obstacles along the path" (74) She correctly asserts that solving the navigation puzzle of a maze becomes especially harder and more disorienting when the player has no complete view of the circuit (top-down view). It is simply because the experience of the space is fragmented (point by point or screen by screen) and the player has to make a mental map of the whole structure (75). She concludes that the [liquid] properties of the digital media could bring about additional challenges through unfamiliar/unreal spatial configurations when the space becomes "dynamic, unstable and ever-changing" (76). In that sense, the Escheresque architecture of this prototype is intrinsically a labyrinth, and it could turn into an intricate/dynamic maze when multiple orientations and scales of embodiment also become integral parts of the navigation puzzle.

Honing the Rules and Restrictions

In the absence of gravity where all horizontal and vertical surfaces could be walkable, visitors could easily lose their direction. The visual intricacy of this maze-like architecture leaves the player puzzled and this is welcomed for the challenge-based immersion it creates. Still some limitations were needed so that the navigation becomes less overwhelming and more comprehensible (fig.23).

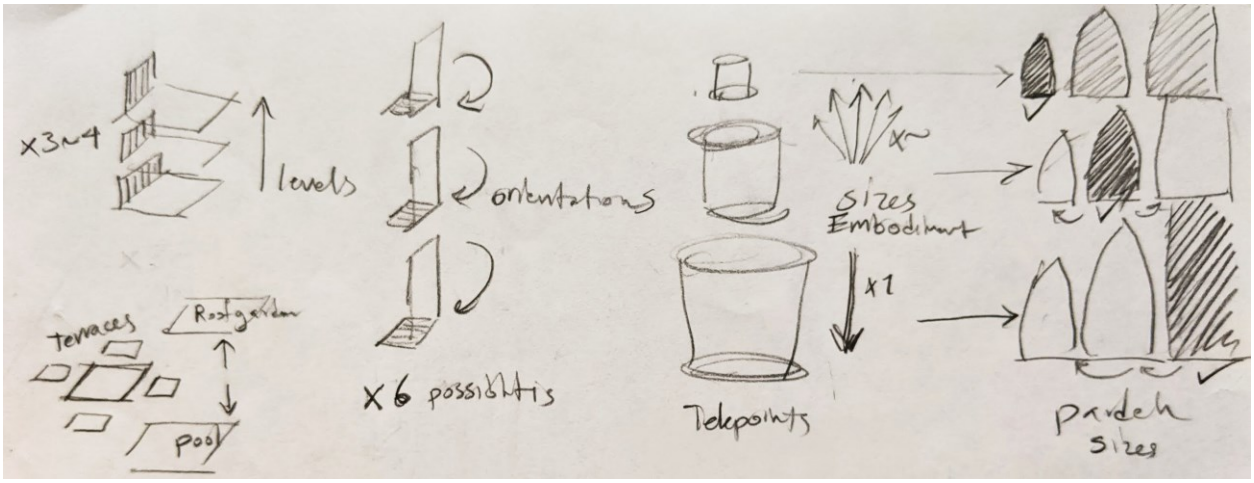

Fig 23. Navigation Possibilities | I was trying to figure out the possibilities that circulation on different levels, orientations and scales allows.

I regarded the orientation which I started modeling *Relativity* with as the main side, and one of its lowest levels as the ground floor where the experience starts off. Then on the same side/level I designed the *Sardam* (stage) with the largest recessed opening behind it reserved for the main (multi-frame) *Pardeh*. Also, among six available orientations, I limited the navigation only to two sides (fig.24_Left). As a result, navigation design started to become more manageable and henceforth I was working only on two unique spaces (instead of six), each consisting of several floors. Of course all the six sides could be exploited for a more complex narrative perhaps in the future iterations. My attempt at this point was to make different spots on these levels recognizable (like landmarks) and give them a sense of place.

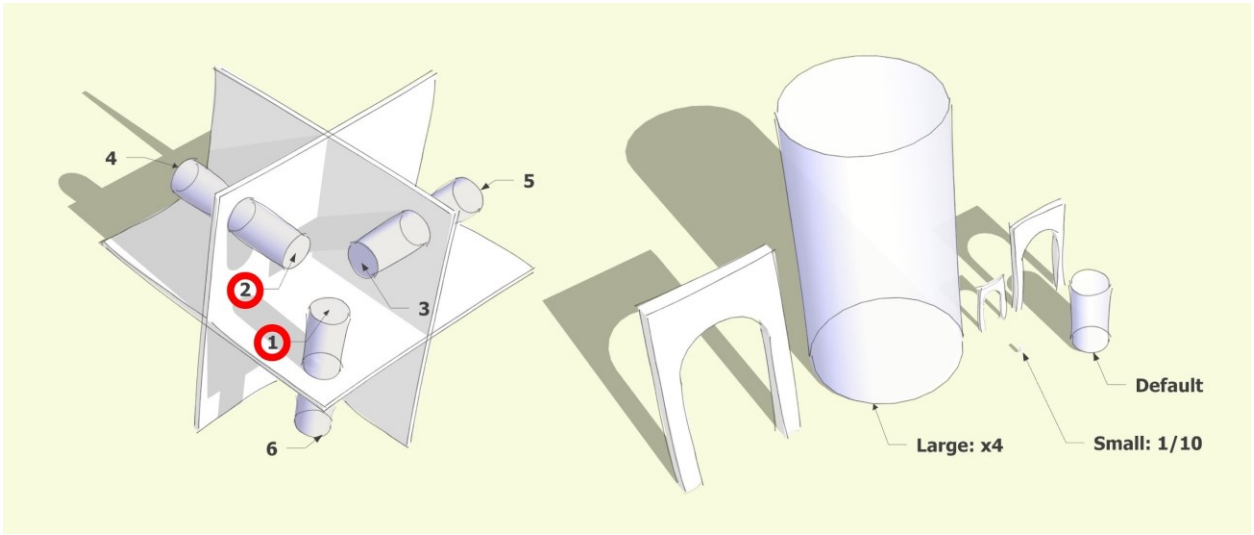

Fig 24. Navigation Rules | Left: Orientation limited to two sides, Right: Scale range limited to 3 sizes.

I limited the number of possible scales for the teleportation points down to three: default (1), small (0.1) and big (4) (fig.24_Right). A wider range would have made the change of scale more obvious, but the available headroom provided only three spots for the maximal 4 times scale. However, scattering an infinite number of small teleportation points is possible, and even the handrails' top surfaces could become walkable bridges. Potential spots for hiding tiny *Pardehs* were explored. I started populating all the levels (of the two chosen orientations) with teleportation points (of the three defined sizes) (fig.25). I was constantly checking them in VR to evaluate which ones have better vantage points and which ones have to be removed. The whole idea was to arrange these teleportation points in a way that the player is indirectly guided towards the *Pardehs* in a meaningful sequence. The linear story of *Pardeh* was still not selected and there was no logic as to where/when the player needs to be transformed. My attempt was to create a flexible system by which the navigation could be choreographed manually for whatever story comes in the future steps.

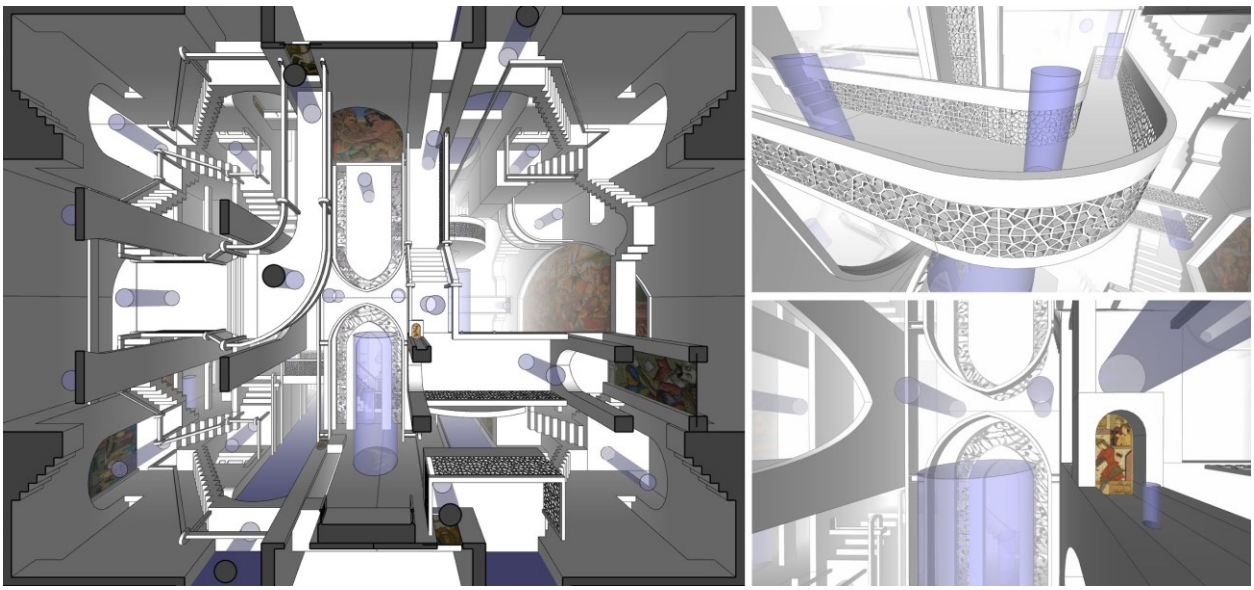

Fig 25. Teleportation Points | I have envisioned three types of teleportation points for this experience: connecting points where the circulation is branched off, ending points on which the player encounters with the main narrative Pardehs, the curiosity points which carry the player to supplemental stories/spaces.

At this stage I had already started exploring the potential stories and communicating with potential artists who will be painting the chosen story on the final *Pardeh(s)*. Meanwhile, this iteration of the prototype was presented and playtestested at quite a few in-person and public sessions to the

faculty and cohorts[15]. I will first go through some of these playtests and the feedback I received, and then will report the modification I have been doing to the navigation mechanics. At the end, I will explain how the *Pardeh* story was chosen for this prototype and how I am still integrating the 2D/3D artworks developed for the chosen story into the space.

Playtests

In a VR show/tell event coordinated by Milieux institute during summer 2019, around 30 people experienced the prototype at this stage, many of them members of Technoculture, Art and Games research center who had tested VR before. I had a brief conversation with each person during and after the experience. Overall, the level of engagement was quite high. "I can stay here forever…" was a frequent comment and although no linear sequence was there to follow, many could easily stay for 20 minutes. Having access to multiple teleportation points was welcomed. People were curious to know about the illustrated characters on the *Pardeh(s)* and their stories, but at the same time did not want to be restricted to a certain path. Some people just enjoyed wandering around purposelessly and getting lost in the labyrinth. Others preferred having an objective to follow. Some were trying to keep track of their navigation trajectory and remember the spots they already traveled to. They were looking back to see if they could find the previous point they were just teleported from. It is easy to lose the track especially when teleporting a long distance while scale and orientation are also changing. I considered two solutions: 1st. To differentiate the already checked teleportation points with a slight change in color/look. 2nd. To add an onion-skin effect, that is to add a ghost avatar on the previous spot which disappears immediately. It could be with or without a particle trail connecting the previous point to the current one. First solutions have been tested and second is planned to be implemented in the upcoming iterations.

I noticed having multiple vantage points over one single *Pardeh* from different levels, orientations and in various scales encourages moving physically and taking different postures. Many players tend to approach the limits of the virtual floors, bend over the handrails and discover hidden points and *Pardeh(s)* they might have missed (fig.26). They were even inclined to climb over the virtual staircases when they were close to them. It is true that the quantity of staircases in this architecture

[15] I have been documenting the key takeaways from these sessions as well as the meetings with the collaborators. Please refer to the appendix for the major ones sorted in chronological order.

prompts using them somehow as means of vertical navigation. However, considering the technological limitations I didn't find any feasible method that could make such a physical interaction possible. I have tried VR experiences in which you can glide over the staircase virtually via joystick while physically being in a stationary position, but they felt very uncomfortable to me. For now, I avoided placing teleportation points very close to staircases. Of course they still play a significant role in leading the player's eye to different floors.

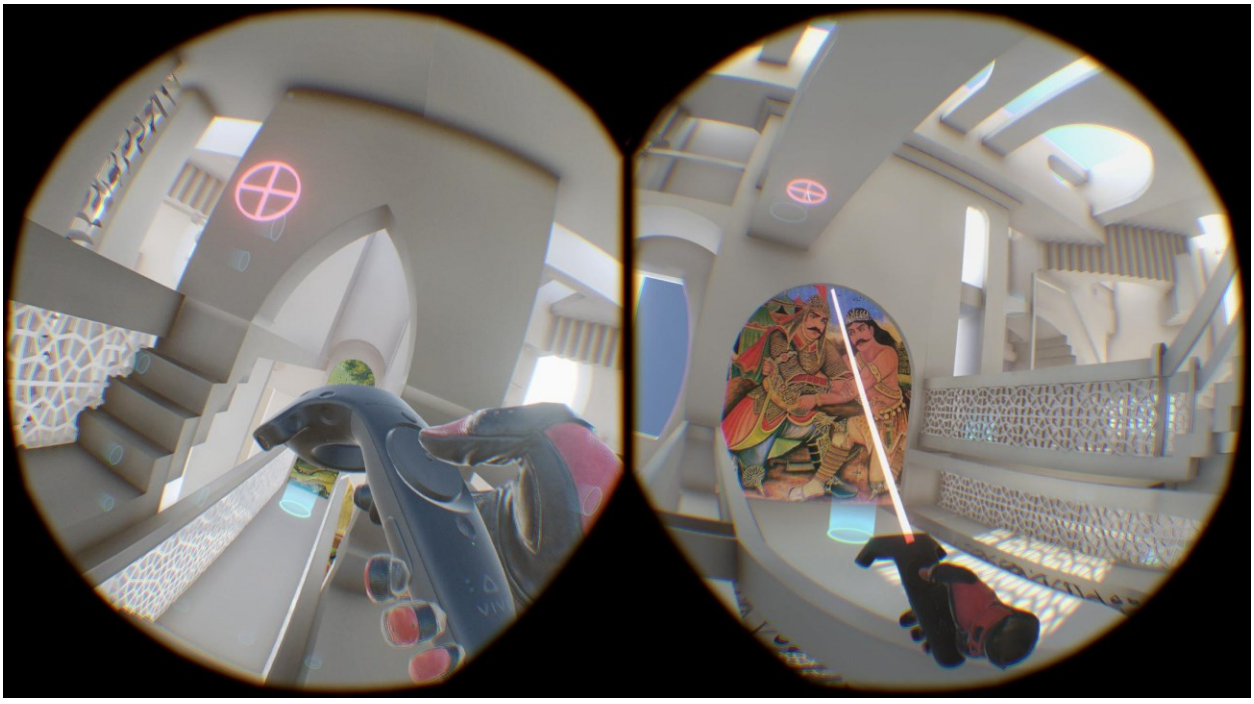

Fig 26. Teleportation Laser-Beam Collision | Making surfaces collide with the teleportation laser beam encourages players to stretch and move their bodies even further so that they could aim for more teleportation points exposed to the laser beam. It turned out to be frustrating to some as the collision was preventing them from teleporting to the visible points behind the wall.

Later that summer I was invited by Najmeh Khalili-Mahani, one of the faculty members of TAG, to share my research-creation to a community of seniors who participated in "PLAY-D-PAIN" research project under the "Serious Games for Seniors" courses[16]. Less than 10 people in their 60s tried it and for some, it was their first-time in VR. They were fascinated by the historical/cultural dimension of it and were even more eager to follow *Pardeh* narratives. In order to make them feel more comfortable we had turned it into a sitting experience by providing them a rolling chair at

[16] The aim of this course was to bring scholars/designers from different disciplines together to develop a personalized approach to researching chronic pain, mainly through the use of new technologies including Virtual Reality. (http://media-health.ca/serious-games-for-seniors/)

the center of the physical room. It was interesting to see them wanting to stand on their feet and walking around after a few minutes (fig.27).

Fig 27. Playtest Session (Seniors) | Engagement of the whole body is one of the things that VR could be celebrated for and I have been trying to include interactions which promote that. But limitations of the physical room started to be a real hassle as I moved forward and I had to consider that all the time.

It is noteworthy to remind that *Pardeh-Khani* used to be a sitting and a much longer experience for its audience especially when performed in *Qahveh-Khaneh*. Since serving food does not seem like an option at least when in VR, virtual benches have no longer any functional use. By removing some of them which were occupying valuable navigation spots, space felt more like a museum. Since joining the interactive and linear narratives together has been a secondary question of this research, I have already had an eye on the museum as a metaphor; a place where spatial, interactive and linear narratives usually come together. *Museum of Symmetry* (NFB, 2018) from the early stages and *Museum of Other Realities* (MOR Museum Inc., 2020) later have been two inspiring VR pieces with the same reference. Not to mention that VR has already an important place in the museums and exhibitions, and is usually treated as an installation art. As mentioned before, I have been envisioning the ways I could design the pre/post VR sections of this creation (the waiting times) as the intro/ending levels of the whole narrative. Many of the good examples of VR experiences I had at Phi center utilized the exhibition space effectively by bringing the mood and elements of the virtual into the physical, so that the transition between these spaces becomes smoother. The sci-fi look of the VR HMDs and controllers had made me consider altering their physical appearance inspired from the props associated with *Qahveh-Khaneh*, so that they better match the digital content.

However, towards the end of this program we were introduced to the *research-exhibition* as a method of sharing in-progress research-creation projects. This caused shifting priorities. Thereby, I started concentrating on the creative ways I could communicate the process during the pre/post VR sections rather than finalizing one polished VR experience (fig.28). Of course the exhibition

strategies and the steps I took were also affected by the global pandemic when the physical exhibition had to be cancelled.

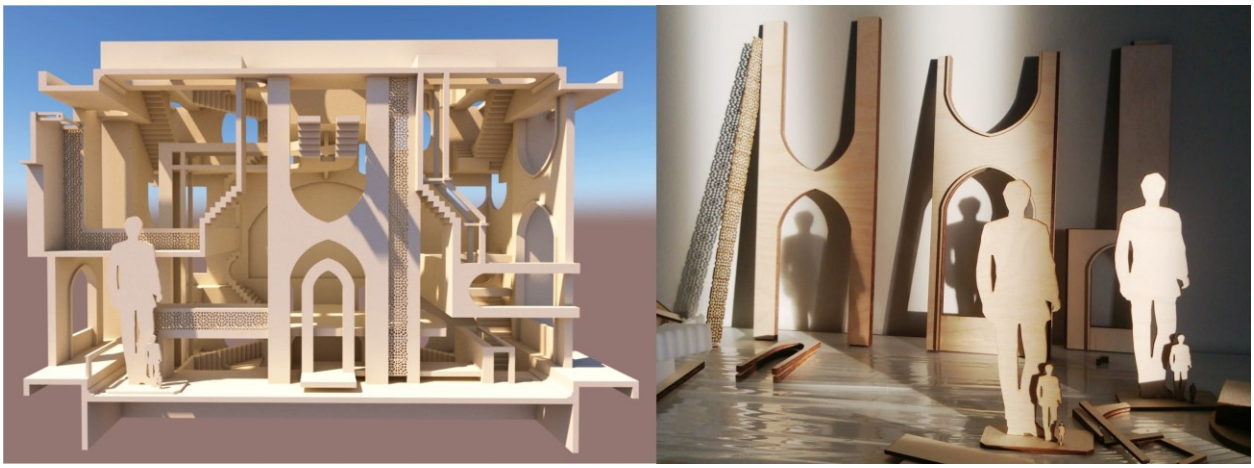

Fig 28. Research Exhibition (Maquette) | I started creating a physical diorama of the space with scale figures so that visitors would be already engaged with its architecture before jumping into VR. This would have put into an immediate comparison the rigidity of the scale in the physical space with its malleability in VR.

Revisions of the Navigation Mechanics

There have been some common issues I noticed in the playtests regarding the navigation mechanics that I tried to address in different iterations. The default visibility of all teleportation points caused frustration sometimes, especially for the novice players who were repeatedly trying to teleport even to the points behind the objects, without noticing that the collision of the laser beam is stopping them. The other common issue was the size of the small teleportation points which made finding them uneasy and aiming the laser pointer at them even harder. Most importantly, change of scale was not always perceivable, especially when the scale difference between current and target teleportation points is little. It is partly due to the nature of teleportation which makes all the transformations occur in a blink of an eye (a default fade to black). It is exactly this jump-cut transformation which makes teleportation the safest in regard to the risk of motion-sickness. The fact that change of embodied scale is something totally unnatural makes the brain easily confuse it with the change of height. That is why teleporting to the large scale points was less comfortable to some people as they suddenly felt they were hanging in the air. Despite that, I found some of these misperceptions become less severe by spending more time in VR, as if the brain gradually registers these unusual transformations as natural. One general solution to the mentioned issues was to extract the change of scale out of the teleportation mechanics and make it separately controllable by the player. Also, by making the visibility/accessibility of the

teleportation points depend on the size and location of the player, the navigation path towards *Pardehs* could be choreographed indirectly. The players will still have the agency to discover and make their own path. Another advantage is that there won't be any need to detect the tiny teleportation points, as they become visible only when the player is turned small. In order to make the transformation change more evident, I also decided to make the transitions visible and examine different animation speeds to see if I can come up with a safe tolerance.

Interactive Scale_Iteration_1[17]

One idea for isolating the scale-change as a standalone mechanic was to make use of the arched gates as scale portals and scatter them around the space. Three types of gates were conceived: Default-size gates which either turn you big or small; Large and Small gates which turn you back to the default size (fig.29_Left). Actually, this experiment was very similar to the gate experiment I covered in the previous chapter, but with visible animation transitions. We also limited the number of accessible teleportation points, using trigger areas (fig.29_Right).

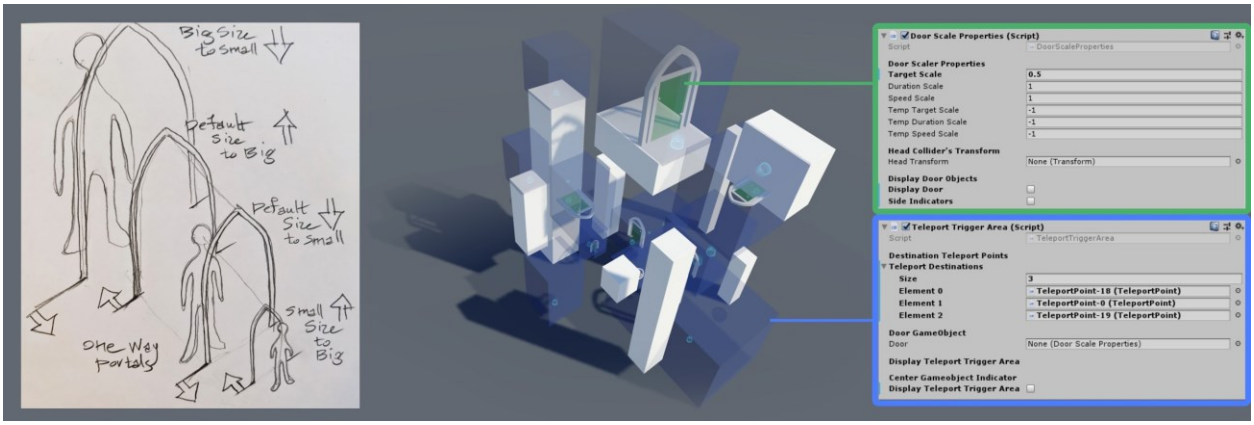

Fig 29. Scale Mechanic (Iteration_1) | Left: Scale Portals. The gates are one-way, so that you only interact with the ones that are at your current size. Right: Trigger Areas. Each box collider is assigned with a list of teleportation points which are accessible only if you are within its boundary.

When we tested the result, we noticed that the visible transformation is less problematic if the animation speed is either very slow or relatively high. The in-between ranges could easily lead to motion-sickness and in case of any lag in the graphic performance this becomes even more critical. The visible change of orientation felt the most jarring one. I also find scale animation harder to accept when it happens simultaneously with your physical movement which was the case in this

[17] This iteration was implemented with the help of Gerald Alvarez, one of the undergraduate students in the Computation Arts Program we started implementing this idea. This task was given as one of the assignments of his independent study course which I co-supervised during the summer 2019.

iteration; a perfect simulation of vertigo. Also when I tested this mechanic in the Escheresque *Qahveh-Khaneh*, I realized that the visible animation of movement and rotation in this complex space will most likely drift the players through the virtual objects which is not something desirable. The other major issue we noticed was the high probability of hitting the boundaries of the physical space so quickly, and finding yourself stuck in a corner of the room. Also the mislocation of the pivot point was more likely when teleportation occurred far from the center. One solution would be to guide players back to the physical center using some audio-visual cue, each time after passing through the gates, or even block the teleportation unless the player is back to the physical center. But this solution contradicted with the one-way nature of the gates and meant walking back into the gate you just passed through with a different scale.

Interactive Scale_Iteration_2[18]

In response to the mentioned issues I started another iteration. I decided to put aside the concept of gates (scale portals) and make the scale change happen on the spot using the controller's joystick. It is very much like and in harmony with the teleportation mechanic itself. We reverted back the visible animation transition to the fade-to-black jump-cut for the teleportation (movement and rotation), but kept it visible only for the scale change with a controllable speed multiplier. The list of accessible scales and teleportation points are now set on each teleportation point independently (instead of gates and area triggers) (fig.30). We also defined a radius tolerance around the physical center beyond which the teleportation will be inactive. They can still walk around and interact with the surrounding environment especially when they encounter the *Pardeh(s)*, but will need to walk back to the center before heading towards the next point. Arrangement of the teleportation points and accessibility that each provides to the next points could be choreographed in a way that players are implicitly guided to explore the whole space before completing all *Pardehs'* stories. Although this iteration of the navigation mechanic has been closest to what I planned for thus far, it has never been tested in public yet mainly due the pandemic.

[18] This iteration was implemented with the help of Mahdi Sadri, a Tehran-based indie game developer.

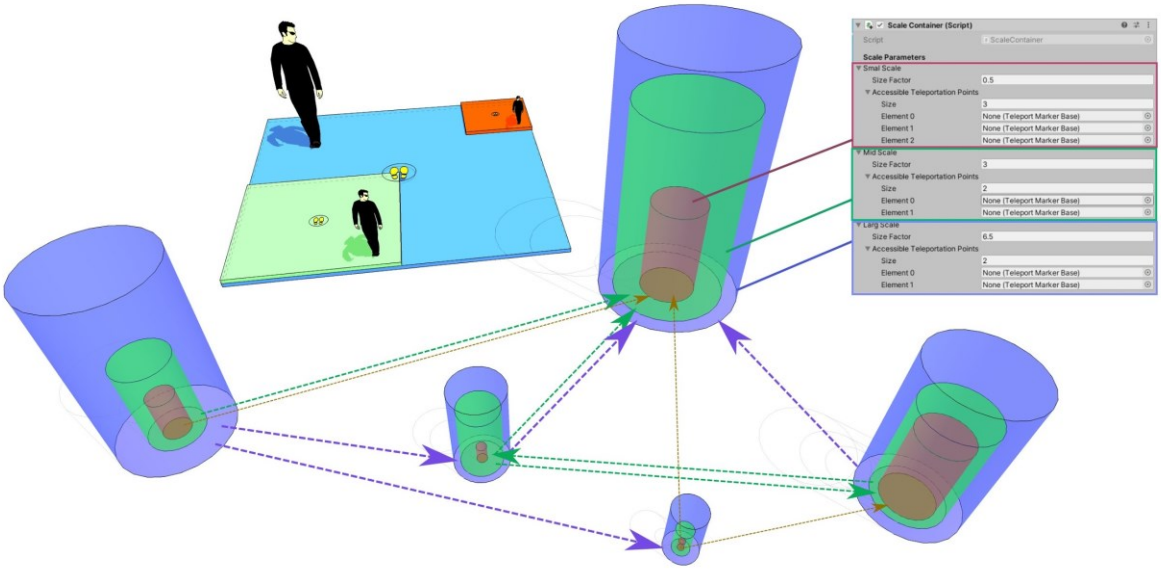

Fig 30. Scale Mechanic (Iteration_2) | You need to get back to the physical center to be able to teleport. Once you teleport, you can choose between three unique scales that your current teleportation point allows via joystick (up-down). Your landing scale on the target point is always equivalent to your current scale; if you are small, you are teleported to the small size of the next point, which is not necessarily the same as the previous point's small size.

Temporal Structure

Beyond the architecture of the virtual *Qahveh-Khaneh* and its navigational rules, another objective was to create a goal and motivation for its spatial navigation. This could be addressed by replacing the proxies I used in the previous iterations with a series of *Pardeh* paintings that depict a clear story to follow. After all, the linear stories of *Pardeh* were the essential components of *Pardeh-Khani* and following them was one of the reasons why people visited *Qahveh-Khaneh* in the first place. Introducing the linear story also helps framing a temporal structure for the whole experience that had been missing in the previous iterations. However, since the free and open exploration was very welcomed by the players, I still considered this as an option in the navigation design. Another objective at this stage was to harness the cinematic use of scale, with a special attention to the characters of the story in the service of the imaginative immersion. An ideal story would of course facilitate the use of scale.

The museum/maze-like space of the Escheresque *Qahveh-Khaneh* furnishes the display of multitude of stories which could be unraveled at once, in multiple sessions or even in alternative versions of the experience. It was a quite common technique by the *Naqqāl* to leave the story unfinished so that the visitors are motivated to come back the next day and listen to the rest of the

story. My attempt, at least for this iteration, was to have a story that could be completed within a one-take comfortable VR experience; which I found to be around 15-30 minutes. Another question was to choose whether I want to insert a popular story that used to be narrated in *Pardeh-Khani* or adapt and shape my own story. It was common for the *Naqqāl*(s) to recite both mythical (pre-Islamic) and religious (post-Islamic) stories but often not together. Some Iranian audiences find themselves preoccupied with only one of these themes and this is partly rooted in the cultural/political dichotomy that still exists in the Iranian society after the Arab conquests (7th century). One of my initial concepts was to come up with a story which intertwines both themes in a critical fashion while touching upon some of today's Iranian socio-political accounts. But soon I decided to put this idea aside for the sensitivity it induces and the time it requires to be fully developed.

Shahnameh: Story of Haft Khan_e Rostam

I decided to use a popular story from *Shahnameh (Book of Kings)* which is one of the most important Persian literary works and a significant reference for *Pardeh-Khani* performance. It is the world's longest epic poem written by a single poet *Ferdowsi* who started writing it in 977 and completed it in 1010 CE. It consists of 62 stories written in over 50000 couplets divided in three cycles: Mythic Age, Heroic Age and Historic Age respectively. The second cycle is the longest one which contains tales of the most famous figures of the book like *Rostam (Romanized as Rustam)* (Mark, 2020). Stories of *Rostam* have been recited frequently in the *Naqqāli* as well.

The tragedy of *Rostam and Sohrab* is one of the best-known stories from the book and is also my favourite one, but it is not so simple nor short enough to be covered within the time span I considered for the experience. Finally I decided to go for the story of *Haft Khan-e Rostam*[19] (*Rostam's Seven Trials*) which has been a popular Iranian folktale and a common subject of *Pardeh* paintings. *Rostam*, the persian hero accompanied by his unique horse *Rakhsh* embarks on a heroic journey of seven stages in order to free *Kay Kavus (King of Persia)* and other Persian paladins

[19] The word "Khan" in *Haft Khan* and *Qahveh-Khaneh* are not synonyms, although they have a similar root which is "Abode" or "House". It is usually translated as level or stage, trial or labour for *Haft Khan*. In *Pardeh-Khani*, it has a different root and meaning which is "Reading".

from *Div-e Sepid (White Demon)* who has imprisoned and blinded them in *Mazanderan (land of demons)*[20]. (fig. 31)

Fig 31. Rostam's Haft Khan | It consists of 7 distinct events which occur in a chronological order.

It is a quite straightforward story with a simple causal chain, therefore the visitor could engage with the plot quickly and follow the narrative without need for a lavish introduction. Besides, its seven distinct segments facilitate its spatial composition over multiple *Pardeh(s)* within the architectural space. More Interestingly, the story of *Haft Khan* is full of characters of various sizes well in line with the other objective mentioned above which is to exploit the dramatic capacities of scale in relation to the characters and in the service of the imaginative mode of immersion (fig.32).

Development of the 2D Artworks

There were some questions to be answered at this stage; How many number of *Pardeh* paintings would be sufficient for the story of *Haft Khan?* What type of *Pardeh* (single-frame or multi-frame) should be used? What visual style would be appropriate for *Pardeh* paintings? Should we restrict the style to the coffeehouse painting style? How many characters does *Haft khan* have and how are their appearances and sizes described in the original text of *Shahnameh* and illustrated in different publications? I started responding to these questions in conversation with Maryam Tabatabaei, a Tehran based illustrator who later joined me in Montréal as an artist in residence to collaborate in developing the artworks. We were exploring how the stories of *Shahnameh* and *Haft Khan* in particular used to be illustrated in different versions of the book and *Pardehs* throughout the history. Based on that, a key step was to make a character sheet (fig.32) and to sketch out rough thumbnails and storyboards (fig.33).

[20] For more information please see https://www.bl.uk/learning/cult/inside/corner/shah/synopsis.html

Fig 32. Character Sheet | White Demon, Dragon, Azarang Div (2nd & 3rd from the left) and Lion and Dragon (1st & 4th from the right) are respectively the largest characters in this story and we tried to exaggerate their sizes even more.

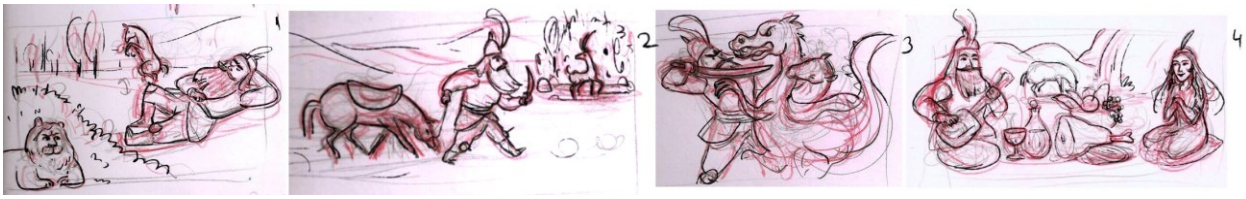

Fig 33. Early Thumbnails | We still needed to estimate the required number of Pardeh(s)

The initial idea was to divide the story into as many as possible number of paintings in single-frames (single shots) and keep the multi-frame type of composition only for the largest *Pardeh* which summarizes the whole story. (fig.34_Left). It was only the look of this main *Pardeh* that we decided to keep more faithful to the traditional coffeehouse painting style; rich in color and texture. In contrast, we wanted other *Pardeh(s)* to be monochrome and less detailed (fig.34_Right).

Fig 34. Pardeh Aesthetics | Left (Main multi-framed Pardeh): Focal point of the canvas was usually reserved for the main part of the story which was depicted larger. Right (single-frame Pardehs): We took inspiration from the aesthetics of monochrome lithography which was a common method for print editions of Shahnameh.

The main *Pardeh* will act like an itinerary plan or a main menu that shows which parts (*Khans*) of the story are completed and what is left to be continued. It won't have any color at the beginning, and it is by the completion of each *Khan* that the corresponding part of it turns colored. We also

wanted to have the character's poses and facial expressions more exaggerated than what they used to be in the coffeehouse painting style, which were more static/symbolic. All this was to make the stories of each *Pardeh* visually more expressive and easier to understand.

We soon realized that we would need around 60 *Pardeh(s)* to be able to cover all seven *Khans*. We noticed that drawing each event separately on a single-frame *Pardeh* wouldn't be very appealing in terms of composition, especially with a low level of detail. Besides, going for 60 detailed *Pardehs* would have meant meticulous labor for the artist, but also for the player who would need to follow the paintings, exploded in very small chunks around such a complicated space. So we decided to compact all 60 single-frame *Pardehs* into only 7 mixed-frame *Pardehs* each devoted to one single *Khan* (fig.35).

Fig 35. Single-frame Pardeh(s) | (3 out of 7) We decided to color only one portion of each Khan; the frame which best demonstrates the essence of that Khan. It is the combination of these colored shots from each Khan that makes up the composition of the main Pardeh.

The location of the main *Pardeh* was already decided (largest frame behind the stage) but picking the right spots for seven *Pardeh*(s) was critical as it directly affects the navigation. This decision was also a prerequisite to finalization of the composition of each *Pardeh*, since the existing frames in the space have different sizes and proportions. At the end, we selected seven frames which have a variety of sizes and proportions and are located on spots with best vistas but also those which

encourage the player to move through different floors, orientations and scales. We intentionally placed the first *Pardeh* (*Khan*) close to the player's initial spawn point so that discovering it wouldn't be a hassle at the start. The remaining spots are still left filled with the proxy paintings, but the plan is to replace them with some bonus paintings which reveal side narratives about the characters.

Development of the 3D Artworks

One of the major questions I have had even prior to choosing the story of *Pardehs*, was how the player would interact with these *Pardeh(s)* and the characters of the story. As discussed in the previous chapter, imaginative immersion is affected by the style of representation of the characters and their worlds. Also, the level of interaction with the characters affects how we perceive their scales and what kind of emotions would potentially be elicited. For instance, it makes a world of difference to see a giant painting of *Div-e Sepid (white demon)* on the 2D canvas of *Pardeh*, or we see him start appearing inside the same 3D space we occupy with a pre-animated cycle, or we find him aware of our presence in that space and is chasing us wherever we go. As mentioned previously, I have been conceiving of multiple levels/spaces for the whole experience, namely: pre-VR real/physical space, three dimensional and surreal space of *Qahveh-Khaneh*, two dimensional and painterly surface of *Pardeh(s)*, three dimensional and fantasy space of the story itself (world of *shahnameh*). Even before choosing *Haft Khan,* I have been envisioning a smooth transition between these spaces. The idea was to offer different intensities of interaction for each of these spaces; from a more reciprocal and playful interaction at the beginning to a more linear and cinematic engagement towards the end. I have also been exploring the possible styles of representation for each of the spaces, and examining how characters could travel back and forth between these spaces.

Many different VR projects were explored and I tried to categorize their visual style based on their aesthetics especially in regards to their characters. I came up with six most commonly used styles which could be categorized in three broad groups: 3D Volumetrics, 2D/2.5D Billboards, and 3D vectors/strokes (fig.36). My goal was to allocate samples of each three styles within the three levels of the experience (excluding the physical space). For instance, 3D volumetric style is in harmony with the 3D space of *Qahveh-Khaneh*, 2D billboard style is what the two dimensional surface of

Pardeh craves for, and 3D vector style is well in sync with the fantasy and dream-like space of the story.

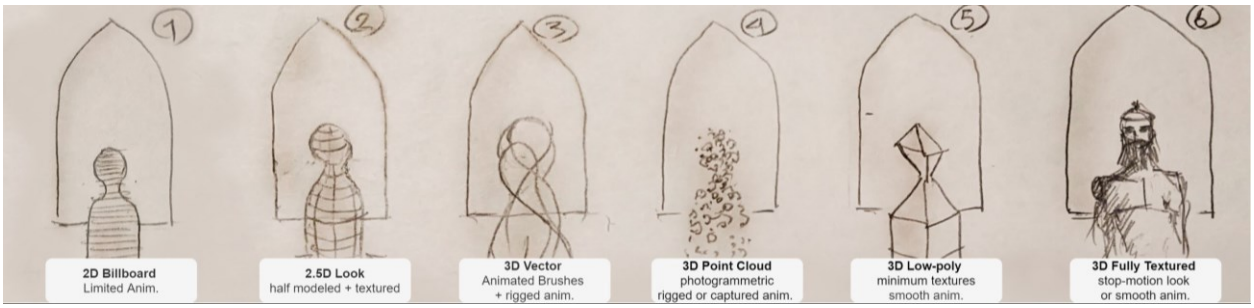

Fig 36. Visual Style Options | key inspirations for these visual categories were respectively: Museum of Symmetry (NFB, 2018), Facebook 3D Photos (responding to viewing angle), Dear Angelica (Oculus Story Studio, 2017), Easter Rising: Voice of a Rebel (VRTOV, 2016), Allumette (Penrose Studios, 2016)

Before reviewing some of the experimentation I did in regards to the interaction possibilities with *Pardeh*, I will first go through the decisions and steps we took to develop the 3D vector look of the story world with the help of Maryam. The idea was to create one distinct 3D artwork for each *Khan* which will be revealed as a reward or checkpoint after the story of that *Khan* is completed (fig.37). It was also the 3d artworks that I wanted to use as the main material for implementing the concept of scale as cinematic shot-framing. Similar to the main 2D *Pardeh* which is composed of all colored frames, we also decided to have a main 3D diorama which is a composition of all 3D art works (fig.38). One objective is to put into comparison the differences of the way we perceive the scale of the characters in a 2D and 3D composition of a single story right next to each other. Also we wanted to transcend one of the limitations that conventions of Coffeehouse Painting style used to impose; it was not common to draw the protagonist much smaller than the demon (fig.38_Right).

Fig 37. 3D Artworks | Each 3D artwork is the 3D equivalent of the colored frame of the relevant Pardeh.

Fig 38. 3D Artworks (Main Composition) | We tried to exaggerate the scale differences especially between Rostam and Div-e Sepid in the 3D artwork of the last Khan.

One of the first decisions I needed to make was to choose a VR painting software and make a working pipeline that would also be convenient to the artist. I started exploring the available tools which offer the 3D aesthetics we were looking for, like Oculus Quill and Google Tilt Brush. I started examining the Quill because of the keyframe animation tools it provides. It is the software that was developed for the *Dear Angelica* project whose aesthetics has been our main visual inspiration for this part of the experience. I tested importing sample animated artworks from Quill to Unity, but the jerky and stop-motion look of the animation did not feel cohesive with the 3D space of *Qahveh-Khaneh*. I found Tilt Brush, on the other hand, way more intuitive and easier to work with especially for 2D artists like Maryam who are generally first time users of VR too. Also Tilt Brush provides a wider range of dynamic brushes with animated strokes which gives the drawing a sense of liveness even with non-animated characters. The open-source Tilt Brush toolkit makes almost all the brush shaders available and ready to modify inside Unity which is not something possible via the Quill plugin. This was particularly useful as I was considering testing dissolve effects similar to those used in *Dear Angelica* for the appearance of the 3D artworks.

Using the character sheet as a reference, I started making low-poly 3D armature/rig of all the characters we encounter in all 3D artworks. Then with the advice of Maryam and reference to the

colored frames of each Khan, I posed the 3D armatures inside the 3D animation software (3Dsmax) and exported them to Tilt Brush. These armatures acted as a 3D guideline for Maryam over which she could better draw and rather sculpt the brush strokes (fig.39).

Fig 39. 3D Armatures | Rigged armatures make possible animating the characters on a loop in the next iterations; now we could export the Tilt Brush *strokes which are actually 3d meshes back to the 3D animation software and skin them to the same rigged armature, animate them and send the animation back to Unity.*

Interaction with *Pardeh*

I was initially thinking of designing unique puzzles for each *Pardeh* and making their solutions essential to the progression of the story. I even found out later that this idea also resonates well with the story of *Haft-Khan*; it would put the Player in seven different challenges in parallel with the seven labors of the protagonist *Rostam*. Several experiments were done for the possible ways we could approach both 2D and 3D *Pardeh(s)* interactively. My priority was given to more VR-specific and embodied interactions which ask the player to walk around and/or interactions which somehow trigger the change of scale. The key concept was to shatter the flatness of *Pardeh's* 2D surface somehow while interacting with it; to make it behave like a portal through which either the characters of the story would extrude out off the canvas or the player could walk into the story world, or a combination of both. I started getting visual inspiration from different non-VR artworks at the beginning (fig.40).

Fig 40. Blend of 2D/3D Space Inspiration (Non-VR) | Left three: The Future Was Then (2016) solo exhibition by Daniel Arsham, whose central theme is the wrecked or liquid 2D surfaces. Image retrieved from: dezeen.com/2016/02/29/daniel-arsham-scad-savannah-college-art-design-installation-future-was-then-eroded-walls-snarkitecture/ | Right two: works of Shintaro Ohata which blend the 2D and 3D spaces together by pulling the characters out of the canvas; left: Good morning, world (2013-2015), right: swing against the sunset (2018). Image retrieved from: yukari-art.jp/en/artists/shintaro-ohata

I will briefly review two of my experiments revolving around the same idea. In the first one, I divided the painting into layers in a cut-out visual style and make them respond to the player's movement; they extrude out and move forward only if you walk towards the painting. The closer you get, the smaller and closer they become (fig.41). The richer the background layers are, the more effective this idea will be. By giving each layer a distinct speed ratio, they would stay at different depths and the parallax effect is created. The other experiment was mainly Inspired by *Art Plunge* (Space Plunge, 2018) which I came across more recently; the 2D painting is literally a portal to the 3D artwork. By stepping through the canvas, it fades out and the 3D artwork appears simultaneously (fig.42).

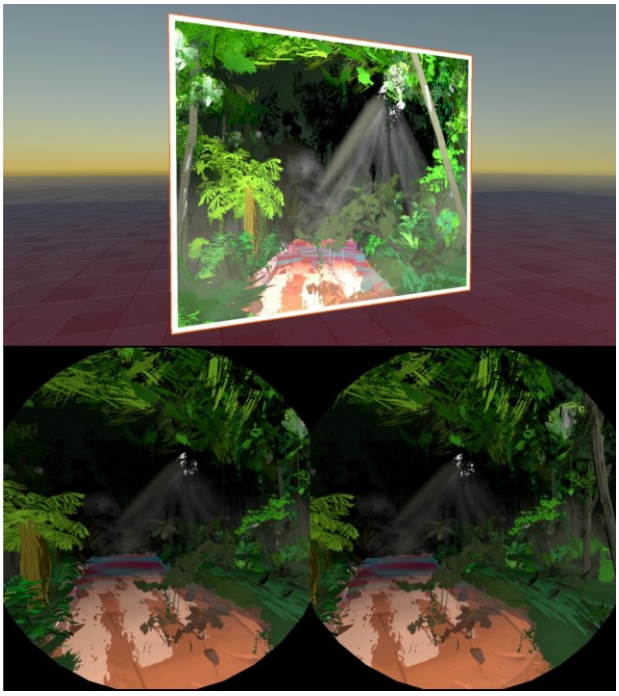

Fig 41. Interaction with 2D Pardeh (Left) | Only the character was cut out in this test. I attached a particle spawner behind the moving layer in the form of persian calligraphy so that its movement is accentuated.

Fig 42. Interaction with 3D Artworks (Right)[21] | We noticed that to make this idea work, the 2D and 3D artworks need to have a similar level of detail so that their dissolve becomes unnoticeable. It was not the case for our artworks especially after we decided to make all 2D Pardeh(s) multi-frame paintings.

However, for a number of reasons I decided to keep these ideas aside at least for this iteration; first of all, as mentioned earlier, the physical boundary of the room-scale VR imposes some limitations for such interactions. More importantly, the maximum 30 minutes one-take experience considered for this iteration, started to make this idea unfeasible. The complexity of navigation is already taking up enough time from the whole experience, and more diverse/complex interactions means more practice time and perhaps dedicated introduction tips. One of the things endorsed by the seniors who are a portion of the target audience for this project was the simplicity of the interactions. Besides, as mentioned earlier, my concentration for this level of the experience was on the dramatic use of scale in relation to the characters and in contribution to the imaginative rather than challenge-based immersion. So I kept the encounter with *Pardeh* and its characters more linear/cinematic, and the design of interactions with them somewhat incidental/juicy. Encounter with the *Div-e Sepid* is the only exception as I have been thinking of giving the player the role of *Rostam* in the last *Khan* and let them battle with the demon. The challenge of the player

[21] Done in collaboration with Mahdi Sadri

would be to find the right teleportation point which grants them a scale bigger than the *Div* so that they could defeat him.

In the current state of the piece; when you approach each *Pardeh*, the story of the depicted *Khan* on that *Pardeh* is unraveled with a voice over which is in sync with the parts of *Pardeh* that are peeled off the canvas and fly towards you. They disappear with a scale-down transition (like a zoom-out effect) one by one. Meanwhile, the whole scene is gradually darkened, and when all frames of the 2D *Pardeh* are gone, its 3D artwork is revealed with a simple scale-up transition (like a zoom-in effect). While a summary of that *Khan* is quoted, the 3D artwork is shown from multiple angles and scales (dioramic to a large scale).

Remaining Steps: Performance of the *Naqqāl* and Other Agencies

I have ended up spending most of the attention of this iteration to the role of the player and their navigation through the space, as well as 2D/3D representation of the *Pardeh* characters (especially *Rostam)*. However, there have also been some important questions regarding other agencies and the possibility of having multi-player engagements of all the characters; for instance, how the *Naqqāl* should perform the stories in this remediated version of *Pardeh-Khani*? Should they have a visual representation in the virtual space or their vocal performance would suffice? If/how visitors/crowd or even *Ferdowsi* (the poet himself) could come to play a role? And if these roles could be interchangeable in some occasions between the player, *Naqqāl* and characters of the story? For instance, would the player be able to narrate as the *Naqqāl* sometimes?

We should remember that *Pardeh-Khani* used to be a live performance and a shared social experience for its audiences. I have been envisioning the possibilities of integrating facets of participatory experiences like live-theatre and multiplayer games, which both have started to hold a prominent place in VR. Social VR platforms and online VR games started to make even more sense after the global pandemic, and I personally started enjoying the social VR games like *Half + Half* (Normalvr, 2020) and platforms like *Rec Room* (Rec Room Inc, 2016) during this time. Escheresque *Qahveh-Khaneh* has the potential of leveraging the dynamics of a multiplayer experience; it offers a space which could be experienced by multiple people at once who could interact with each other playfully at different scales. It is quite plausible to think of it as an online

VR social platform very much like *Museum of Other Realities* (MOR Museum Inc., 2020), where visitors could login and gather on certain occasions and enjoy the live-performances of the *Naqqāl(s)* (who have distinguishable visual representations), and follow different stories/paintings which could also be updated in each event. However, designing for a multiplayer/online VR experience brings up a whole new set of technical challenges (hardware/software/design) well beyond the scope of this research and the duration of this program.

One of the final steps I took for this iteration was working on the proxy voiceovers for the *Naqqāl* without any visual representation. Although *Naqqāl(s)* used to be men most of the time, I am still figuring out how to go about the gender and language. So far, with the help of my spouse Simin Farrokh Ahmadi, who has been involved in production of several VR 360 documentaries in Montréal and has voice acted in some, we created prototype voiceovers for each illustration. The plan is to eventually have both Farsi and English versions selectable at the beginning. For now, we used English for the narration of each *Khan* and few summarizing couplets in Farsi when the 3D artworks appear. We took the English translation temporarily from *heritageinstitute.com* (K. E. Eduljee) which I found to be a rich resource about old Persian history. And we took the Farsi parts from the popular podcast series of Amir Khadem, PhD in Comparative Literature from the University of Alberta who has narrated several chapters of *Shahnameh* so far.

For syncing the text to every frame of each *Khan*, I imported the pre-final drafts of all *Pardeh* paintings as well as the proxy voice-overs to video editing software (Davinci Resolve) and started cutting and editing. (fig.43) I also added some sound effects and ambiance, even though most of these effects were used to be produced by *Naqqāls* themselves. I wanted the pace of narration to be fast enough so that the total narration time doesn't exceed the 20-minute limitation. Hence I had to sacrifice some parts of the text which are not so crucial. Also we realized that the tone of the Middle-English translation becomes a bit hard to follow especially when narrated by a non-native English speaker, so we decided to simplify the text as well.

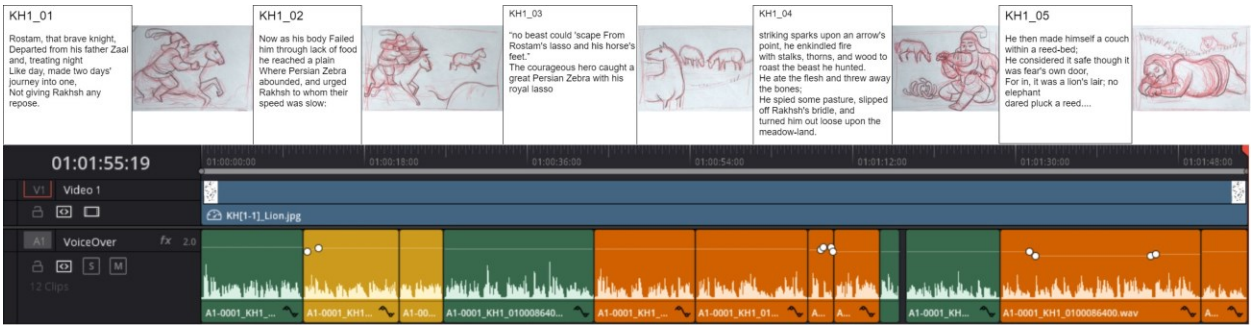

Fig 43. Voiceover Timeline | This is the timeline of the first Khan. The audiotrack of each part of the painting is labeled with a different color. My attempt was to keep the total time for all the Pardeh(s) approximately the same.

Chapter 5 | Conclusion

This research was pursued in response to two main objectives: 1st. To explore what narrative affordances the unique perception of scale in VR could bring about, 2nd. To prototype a culturally charged VR experience which encompasses spatial, linear and interactive narratives and utilizes scale in all these facets. In the 2nd chapter, I discussed the rigidity of scale and its perceptual relativity in physical reality: I explained that it is our own body size as well as the presence of standard-sized artifacts which come to assist us in how we perceive the scale. Then, the significance of the frames as scale references in non-VR mediums was highlighted. I surveyed some of the non-VR screen-based games that employ the notion of scale in some way. I observed that scale has benefited the explorative nature of the reviewed games.

In the 3rd chapter, I first outlined some of the technological specificities of VR. I argued that it is the absence of frame as well as the absolute liquidity of objects' scale, but most importantly our own virtual size which afford narrative possibilities unique to VR. I examined how scale could leverage three modes of immersion, namely: sensory, challenge-based and imaginative. Then I studied a variety of VR cases which have exploited scale in one way or another. I overviewed my own experiments with scale with regards to each type of immersion. I argued that the inherently more sensory and spatial immersion of VR makes confrontation with massive entities more viscerally impactful. This is also what makes VR a suitable medium for spatial visualization of natural phenomena of micro and macro scale. My second argument was that scale is barely exploited in VR as a dynamic/interactive element, or as a central component of the gameplay. The

key takeaway was that VR-specific challenges could result from being able to interact with one single environment in multiple scales.

My third argument was that in order to study the possible contribution of scale to the imaginative immersion, the narrative context and level of interactivity of the characters should be taken into account. My focus was on the characters as they are the most essential formal element of the storyline. I analysed the effects of encountering them in different sizes and in three narrative contexts; spatial (gallery), linear (cinematic) and interactive (game). I observed that the static characters with photo-realistic details in merely spatial experiences could provoke uncanny feelings when they are small or gigantic, or when they are normal-sized but familiar (3D scans of yourself).

I continued with an emphasis on the importance of the camera in mediating our engagement with characters, especially in non-VR cinematic narratives. Since the camera is not a separate entity from the viewer in VR, I explored how the cinematic language associated with the camera performance could be translated into VR. Given that, I examined three different scale-relationships between the viewer and the character as the equivalences of three ranges of camera shots; medium-shot, close-up and long-shot. I learned that engagement with the characters with similar sizes to our own, feels more cognitive than emotional; it could also feel uncomfortable if they are humans with photo-realistic appearances. The most empathetic engagements are when the characters are much smaller and staged in a dioramic setting. This size-relationship functions pretty much like a close-up shot in bringing us psychologically closer to the character. Although encountering large scale characters could potentially operate like a long-shot, it is mostly used to astonish the viewer in front of the massive creatures. It is because the visceral impact of such encounters in VR still dominates other emotions. Perhaps by getting accustomed with the sensory effects of VR, this scale-relationship could be exploited further for communicating other feelings. I noticed that the scale of virtual embodiment that we enter the experience with (i.e. landing scale) affects how we register the characters' actual size as well as our own default size. Overall, there were only a few cases in which scale differences between the viewer and characters were used dynamically like how framing operates in cinema.

I also reviewed two VR games with strong imaginative immersion which revolve around a small player character (PC) and a gigantic NPC respectively. I found that controlling a small character in VR is totally different than moving them on a flat-screen medium. Because of our inevitable virtual presence, PCs are more easily perceived as independent living beings, rather than our own avatar. Hence our relationship with them would potentially be more empathetic. Simply put, I noticed that characters in VR become our imaginary friends more easily as we are literally situated in their imaginary worlds.

The key takeaway from these explorations and experiments with scale in VR, is that the creative manipulation of scale of the experiencer's virtual embodiment could bring about spatial experiences, gameplay mechanics and cinematic syntaxes unique to VR. It could create unprecedented connections with other virtual characters of different sizes. Change of viewer's scale in VR seems to have an equivalent weight of editing film in linear narratives, and it will have a definitive role in shaping various genres of VR games as well. That said, it is only the sensory impact of the scale which has been exploited the most in VR thus far.

As explained in the 4th chapter, I decided to go for the Iranian traditional culture as the main source of inspiration for developing a stand-alone prototype which benefits from the notion of scale. I elaborated on how I eventually focused on the *Pardeh-Khani* (a screen-based form of storytelling). Firstly, because its remediation in VR is considered a contribution to safeguarding an intangible heritage which is even recognized by UNESCO as one of endangered cultural species. Secondly, because *Pardeh-Khani* already consists of spatial, linear and interactive dimensions which makes it an ideal subject matter to be translated into a VR experience. M.C. Escher's *Relativity* was a key inspiration for manipulation of the *Qahveh-Khaneh* (coffeehouses wherein *Pardeh-Khani* used to be performed). Illusive/surreal as well as geometric/spatial complexity taken from this work led to creation of a labyrinthine space which could perfectly host *Pardeh-Khani*, but also justify a more playful use of scale. At this stage, the main attention was given to creating, playtesting and revising the navigation mechanics. The goal was to make scale contribute to the sensory immersion in the space but also position it as a central piece of a navigation puzzle. The proposed mechanic asks the player to change their scale of embodiment frequently in order to be able to follow the linear

story of *Pardeh*. This in return would give them the chance to experience the space in a myriad of vantage points too.

With the plan of making it an average 30-minute experience, the story of *Haft Khan_e Rostam* was chosen, for its simple plot and cast of characters of different sizes. Most importantly, it was chosen for its seven distinct *Khans* (sequences) which allowed dividing and scattering it around the space. At the current stage of development, there are seven illustrated *Pardehs* in mixed-frame compositions and various sizes and proportions, each devoted to the story of one *Khan*. All the frames are monochrome except for the larger frame of each *Pardeh* which depicts the key event of the illustrated *Khan*. Seven distinct 3D artworks were also created for each *Khan* which will be revealed as a reward after completion of that *Khan*. There is also one largest 2D *Pardeh* which is a composition of all colored frames from each *Pardeh*, and one dioramic 3D artwork consisting of all seven 3D artworks. They both function like itinerary 2D/3D plans which display what parts of the story are completed. They also provide the occasion to compare our perception of a 2D and a 3D composition of a single story in two different styles and scales.

This is an ongoing project and there are still remaining steps to be taken and some important questions to be answered. For instance, the method of representation and performance of the *Naqqāl* (narrator) deserves a particular attention. A considerable care was given to the spatial design for its importance in any VR experience. The navigation mechanics also took a good number of iterations to meet the challenges generated from being a room scale VR experience. However, a crucial aspect of *Pardeh-Khani* experience is related to the imaginative engagement with its story and characters. Characters are static at this stage of the prototype, and the *Naqqāl* is a pre-recorded voice over without any visual representation. I am still considering putting them in different levels of interaction with the visitor. For instance, 3D artworks could start to have an animation cycle after finishing a certain number of *Pardehs*, and at one point *Rostam* would seem to be aware of your presence and finally in the last *Khan*, you embody *Rostam* and battle with the *Div-e Sepid* (White Demon).

The complexity of the Escheresque *Qahveh-Khaneh* as well as the fact that *Pardeh-Khani* used to be a live performance with social dimensions, makes the project crave for a multiplayer version.

Therefore, turning it into a social VR platform especially in the time of pandemic seems like a legitimate step to consider for the future. It is not foreseeable to showcase neither the prototypes nor the final iteration in gallery settings. The upcoming plan is to disseminate the whole research context, questions and process online, perhaps partly on Mozilla Hub. It is a widely accessible online platform even for non-VR users. Unlike a normal website, it allows designing a virtual exhibition consisting of rooms like hyperlinks. Although its technical limitations and performance considerations don't allow sharing the experience itself, it could be curated like a physical research-exhibition for sharing the contextualizing material as well as the creation process. For the experience itself, Steam and/or Oculus platforms are considered to be used to share the last iteration after finalizing everything in one scene.

VR is still considered a technology that is not mature nor accessible enough, and a medium whose communication language is not set in stone yet. This research-creation contributes to researchers, designers and narrators who look for better understanding the particularities of this medium and unique narratives it could afford when compared to non-VR mediums. This project also raises awareness about the marginalized traditions of storytelling through the lens of new technologies. It shares challenges of, and proposes possible solutions for remediating a screen-based experience in VR.

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Appendix: Documentation of Feedback / Takeaways Collaborators' Meetings / Playtest Sessions

2018-06-08 | Meeting with Tester #1 (Milieux VR Lab)

- - Could bring the question of "how VR facilitates cultural translation" to the surface and let the notion of scale be a complement. (emphasize it in the proposal)
- - How VR could contribute to a left behind medium of Pardeh Khani, How VR could remediate and promote the Pardeh itself?
- - How the whole experience, traditional culture of immersing into the PardeKhan's narration and Pardeh's illustration could be remediated via VR and particularly this three-level experience. What VR could significantly add compared to the original traditional medium and what does it lack?
- - Don't let the question of scale act as a barrier and do what really matters to you.
- - Even you could put the notion of scale as a peripheral concept and focus on the idea of Translation of Shahnameh into VR.
- - I can ask for help from Computer Science students (offering them Independent study course in our department)

2018-08-30 | Meeting with Tester #2 (Holodeck)

- - comment on the teleportation (thinking of the logic or at least making it visually and kinetically relevant to the design of the space, think of perhaps a good culturally relevant metaphor for the teleportation and visualize it in VR)
- - taking the character(s) from each panel and carrying them on hand or maybe putting them in another panel (maybe last panel) to trigger the stories of pardekhan. (borrowing from the interaction methods in the game scale (steve swink, 2012))

- - notion of non-optical scale of the pardeh's characters could be the main concept to grapple with and shape everything else around.
- - the good point is that the pardeh, pardeh khani and qahveh khaneh creates a good platform for fusing the question and objective of the research; *(traditional-pre-cinema Iranian story telling (pardeh khani), using affective effects of scale in VR. (maybe the title)*

-height was commented by both Tester #1&2 to be low for typical QH

2018-08-31 | Meeting with Tester #3 (Holodeck)

- Tester#3: the story of Perdehs (single & mixed) should be overlaid and mixed strongly with the story of the viewer (player):

- technically speaking, whole experience framework of the level 2 could be based on a cyclic (loop of events; people doing repetitive, sounds are looping), teleportation points are bridges to level 3 world which could be based on linear sequential events that pull the viewer out of the cycles, and when taking the viewer back: something is changed in level 2 cycle (visual, pace,…), elements of the level 2 reality is collapsed and a window into leve3 become permanent in level2 (idea of how you carry emotional non-physically interactive, linear stories of abstract reality into the interactive, cognitive world of photo reality (level 2) and physical reality of level 1 (or 4))

- Level 2 (cyclic framework) + level 3 (sequential framework) are intertwined in this way. Teleportation panels are bridges that connect the level

- *level 2 (qahveh khaneh*):

- how people are visualized could(Should) better replicate the way people used to behave in similar spaces (sitting, chatting, drinking, smoking), they used to be in sitting positions and things (including pardeh khani) happening around them. families not only populating but also inhabiting the space. So should the whole experience be sitting or standing or combination of both?

- architecture of the level 2 is still not replicating the atmosphere of the qahveh khaneh (maybe it's intentional, but it's more of a museum and cathedral; maybe the abundance of columns)

- Smooth transition between levels 1,2,3: (Alternative controllers design could be informed by the real props of the qhahvehkhane; teacup, shishe, pardekhan's wand…):

- vive & oculus controllers and their whole interaction interface may not match well with the experience

- let the viewer carry a tea cup during the level 2 (or 3) s an interactive component

- i.e. Tester#3: as rule of play; viewer should be conscious of population of people around and sync his drinking action (or any other contextually relevant actions) with sitting character's drinking while gazing at them in order to teleport to their position and hear about other parts of the story (characters) and eventually the last Pardeh. (saucer and teacup could act as mouse trigger; alternative controller)

- instead of waiting for the last pardeh to become the portal into the fictitious world of the Level 3, this transition could start gradually while moving around the single-framed *Pardehs*; architecture of Qahveh Khaneh (of level2) starts to vanish or collapse and letting the viewer gradually find him/herself in the middle of 3rd pardeh,

- in the level 2, interaction with each single-pardeh could take the viewer into the POV or intimate distance with the characters (with the visual style of the level 3) where their scale could be compared (I.e. flying with the *Simorgh*, or seeing it flying around), so this way, not only the last mixed-frame pardeh but also the single ones are small windows to the level 3 abstract world

- solving each puzzle of the teleportation point will let glimpses of level 3 to sink into the level2

- level 3 could be seen ad implemented as the bigger world around the 3d construct of the qhahvehkhane at level2 (a huge world (dome) of fantasy and abstraction which is wrapped around the world of level 2 and gradually will penetrate into it, by teleporting around the *Pardehs*)

- in the level 3, parts of level 2 including people and architecture could still remain there; or maybe the main remaining things from level 2 will be the main P*ardeh* and pardeh khan and all fictitious characters and the main story about them happens around us.

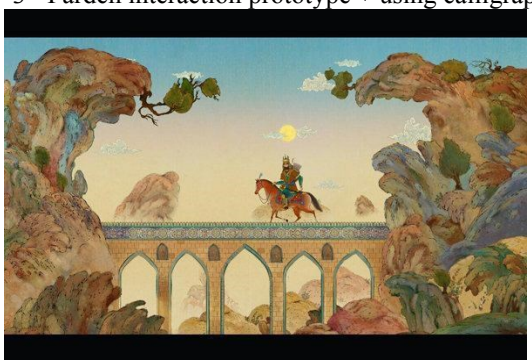
- Since I want to break the symmetry of the qhahvehkhane, spatial design of level 2 could be inspired from the mysterious worlds of M.C Escher

- the idea of storytelling is to let the listener, remember, reimagine and reflect on the story and carrying it with in the real life; same thing could happen in this experience; after HMD is taken off, the viewer could find him/herself, in front of a large spherical/cylindrical curtain with the same illustrations (the journey should end in a meaningful way, pushing elements of the narrative out of the level 3 into level 4 (which is back to level1)

- whole story and experience could also implicitly reflect some of the current socio-political conditions (as qhahvehkhane and pardeh kahni used to have socio-political dimensions)

2018-08-31 | Meeting with Collaborator #1 (Online)

- - Pardeh images and qahveh khaneh images send and received via Telegram
- - I demonstrated the progress:
  - - 1st iteration prototype of Qahveh Khaneh through Windows Mixed Reality
  - - 2nd iteration, Escheresque QahvehKhaneh
  - Interaction with Pardeh ideas:
  - - 3d paintings ideas (layers) (parallax)
  - -3rd Pardeh interaction prototype + using calligraphy to add depth



- Collaborator #1 agreed with the idea of calligraphy - conversation with other visitors - the miniature concept (both liked it)

- - idea of the last *pardeh* reserved for a critical message which resonates the current iran-global socio-political climate
- - idea of one of the characters is lost and trying to find his/her canvas and you help on the journey
- *Next steps we agreed:*
- - Exploring shahnameh and start narrowing down the short story idea (Farsi, English – audio and text)
- - working on possible interaction with Pardeh(s) (+scale in this interaction & scale of embodiment)
- - Search a good translated (English) version of shahnameh
- - she tries to find a place where she could try the spatial VR, so that I will send here the playable iterations for (vive or oculus or WMR)
- - research about the Tilt Brush in Unity and if Collaborator #1 could start trying it
- - research on vector cell animation in VR (full animated polygonal style vs brush transition vector style)
- - avoid over expanding the story and complexity

2019-02-06 | Meeting with Tester #4 (Milieux VR Lab)

- - Tester# 4 raised the idea of the player as the narrator; s/he doesn't know precisely who the characters are, but after navigating through space and interacting with characters, s/he starts to have subjective interpretation and narrates it back to the other audiences.

- - multiplayer might be a good way to invite more people in the experience at once (more real time performers)
- - interaction with Pardeh(s)was very well received by Tester# 4. He brought the book *MidNight Creatures* as an example playing with parallax and light to find meaning on the painting

2019-02-08 | Meeting with Tester #2 (Milieux VR Lab)

- - liked the characters being blocked by the architectural forms
- -very well received the interaction with curtain prototype 1:
  - he was amazed by the character passed through the chest
  - chest is not the place where you interact in real world, so this seems real as there is no indexical reference for the user to compare the drawbacks
  - The idea of absorbing the character is cool (it could be anything, playable objects, things to carry)
  - calligraphy particles were also well received
  - some Pardeh(s)could invite you inside their world with linear stories, and some could get out to be interacted in a more emergent form of narrative

2019-02-06 | Meeting with Tester#1 (Milieux VR Lab)

For the physical exhibition:

- HMD design could be made of fabrics - with Iranian motifs/since the HMD design speaks by itself and we want to avoid Star Wars readings
- To involve visitors to participate and prevent them being waiting doing nothing prior to virtual experience, there could be some art crafts; posters of pardeh, brochures, audio? sculptures(printed), curtains?
- They could conceive different meanings before the VR and after the VR HMD is off and during the circulation in the booth.
- Theme of the exhibition could be curtains; the player starts there and after putting the HMD they see again the same curtain, same position, pass through it physically/virtually and experience starts.
- Think of the ending also?
- Borrow from street performances; how they trigger the curiosity of the people in distance (*Mareke Giri*)

Virtual World:

- Although stairs afford interaction, the teleportation could be always in a certain distance to them so that they don't physically get close to be invited to interact
- Good idea to have different interaction styles, so that the viewer is not bored with the mechanics; element of surprise and will motivate them to continue navigation.
- Cultural museum where you as visitor invited to engage in unravelling the stories (just by removing the curtains off the cultural mysteries)

Haft khan:

- Its good idea (instead of taking characters and stories from different parts of shahnameh), because the viewer could relate to it much quicker
- Pardeh(s)could be unlocked chronologically; (numbering for pardeh?), although they are spatially scattered around, and you have to explore (how to make this discovery and unlocking playful)

Critical aspect:

- Even if it's all about revitalization of a traditional culture, it's good enough.
- Either you will decide to have a clear stance about the relationship of Iranian culture/politics in relationship to western, or you keep it hidden and implicit to be speculated by the viewers (some hints)
- It's good to have some heritage readings (what they do? Their objectives and mandates (so that finds parallels); the significance of this project could be in its effort to keep alive a heritage at risk (Unesco), a dramatic curtain based performance which was once suppressed by the [silver] screen based medium is revitalized with a newer [on your face] screen based medium (VR).

Notes on Haft Khan:

- sequence of putting linear and emergent narrative could be reversed: 1st Pardeh(s)more linear so that the player gets familiar with the context and gets the motivation to play as Rostam and fight the Div . SO:
- 6 labours (mostly linear narrative) (either moving inside the pardeh's world or extracting out its characters)
- 7th labour (for Dive Sepid, you are not a visitor anymore but Rostam and you've got to defeat the Div. the world of qahveh khaneh and the Div could become one, qahveh khaneh architecture is demolished by the Div)
- for each pardeh, role of player could change similarly; ex: being narrator for some (like Collaborator #5's idea: have to spell out the poems in finglish/coupled with farsi to tell the story of that particular pardeh; consequently, the story he/she said will be restated back in English)
- for the other, the player could become the Rakhsh

2019-03-15 | Meeting with Collaborator #2 about artworks and possible collaboration (Online)

- - introducing the project; remediation of the ritual of pardeh khani which consists of spatial, interactive and linear narratives ad VR wee affords them all.
- - about visual style and the fact that I'm thinking of: 3 different visual styles:

  1- 3d vector (like Dear Angelica) (inside Pardeh(s)worlds)

  2- 2D billboards (-flat 2d: like Museum of Symmetry, NFB) (pardeh elements extended out)

    - 2.5D like Facebook interactive photos, projected textures on half-constructed wireframes of the character

  3- 3D polygon art (for elements inside qahveh khaneh) (crowd, padeh khan):

    - - Photogrammetry/point cloud/volumetric style (like Easter Rising)
    - - Low poly with optimum textures, yet fluid animations (Rose and I)
    - - Stop Motion-like, low FPS with rich textures (Allumette, Wolves in the walls)
    - - Pixar-like, high FPS with rich details (Crow: the legend, Piggy)

** as surprising strategy, they could be combined: i.e. 3d vectors inside qahveh khaneh, 3d poly art as pardeh elements extruded out, 3d poly art when you are inside pardeh worlds

- - Collaborator #2 reminded the game *Serious Sam and Portal, and* spotlight stories *Age of Sales VR*.
  - - Research travel to Iran's traditional sites?

2019-03-19 | Meeting with Tester #1 (Milieux VR Lab)

- Consider 10-15 min experience? (divided by number of *pardehs*)
- No time to engage viewers/players in complicated mechanics; no time to teach them what to do (consider it like a museum) (intense challenge based immersion might not work)
- Since the experience is short, whole the experience should be tailored carefully (and start and ending need to be satisfactory)
- Since it starts with peculiar architectural space, it gives a visceral engagement
- Next thing is how to motivate them to move; the answer is how to engage them with the 1st pardeh, on which spot the experience starts?
- each player might find their own reason to continue (to enjoy the new surprises, to understand the story, to accomplish/unlock all the experience, to see the changes that occur when each pardeh is experienced, so forth)
- The teleportation will be the core mechanics that engage the viewers all along.
- Each teleportation point should be placed wisely, answering the question of which point /track the viewer might wish to take. Some points could be visually blocked by the architectural elements.
- Each pardeh entails a small surprise in its narrative, interaction, (a different taste)
- Illustration style of each pardeh could suggest unique interaction mechanics.
- Teleportation is an allegory of the 7 labors which rostam is going through. So it also adds to the surprise and motivation to continue if passage of time is gradually visible step by step as the player is going through

the 7 pardeh (7 labours). So the player is also changing (*Gorogoa* game is relevant as it depicts different stages of the character's life).

- Some examples were shown or discussed with Tester#1:
    - Gorogoa
    - Tale of wedding Rings
    - Portal
    - Monument Valley
    - Machinarium (each pardeh suggests simple interactions)
- Updated Tester#1 with discussions I had with Collaborator #2 about possible visual strategy:
    - 3d Vectors / 2d billboards / 3d polygon art
- Remaining questions: How to implement change of scale of embodiment?
    - Throughout teleportation?
    - In interaction with *pardehs*?
- Possible Travel_ Tips:
    - Documenting and photogrammetry could be also valuable, both using the captured geometry and textures and even the overall atmosphere.
    - Condensed meeting with teammates in Iran
    - Possible events and talks?

2019-04-13 | Meeting with Collaborator #1 on HaftKhan (Online)

- Collaborator #1 demonstrated her rough sketches of the *Haftkhan* (except the last one).

- her sketches had the cuteness signature + dynamics of animation story reels, when compared to aesthetics of Pardeh(s)which used to be more static; characters were not in extreme expressive figurative and facial poses (rigid poses with limited facial expressions), though with a rich texture and color pallet.

- since the esheresque qahaveh khane affords myriad spaces to present different Pardeh(s)of different sizes and orientations, and also Collaborator #1 felt that some *khans* call for more number of illustrations as they are longer, it came to me that the biggest pardeh could play as the main mixed frame pardeh with adherence to the visual aesthetic of the traditional Pardeh(s)and function as an itinerary map on which the navigation track of the visitor is traced. (this map could be printed as the main poster of the exhibition and small maps maybe)

- scattered pardeh will be devoted to as many as animatic(storyboard)-like illustrations with less details on color and texture (maybe without color and only line work; Collaborator #1 suggested Iranian plaster molding, using light to interact with the bumps) and dynamic in terms of character postures.

- categories of main characters were discussed: we have and main narrative settings and visual style; Visitor, PardehKhan, Pardeh Characters, other virtual visitors, other real visitors in que/in conversation with the main visitor (or acting as another player) and Ferdowsi.

- The main setting and visual style for the visitor and pardeh khan (whom his voice act is vital to the experience is escheresque qahveh khaneh and their visual style as 3d model (polygonal, photogrammetry….) (**ابوالحسن تهامی**).

- for pardeh characters it is the locations described in the haft khan, and their style is basically flat 2d cell when on the curtains > flat cut out and/or 3d vector and/or 3d polygonal when extracted out of the canvas. Styles and settings of the characters are interchangeable, for instance we could find pardeh khan in one of the pardehs; Rostam could become the narrator (POV); we could become the rostam when for example getting into battle with the Dive Sefid (as a metaphor for the visitor going through the same labors of Haft Khan); Dive sefid could find way to the qahveh khaneh space and continue battle inside it while damaging it; we could see the same qahveh khaneh illustration in one of the Pardeh(s)when Rostam takes a nap there; visitor could become the padeh khan ….

- Pardeh khan (narrator) voice actor; Farsi? English? French?

- Collaborator #1 suggested that features and props of each curtain could leave the visitor with a hint for finding the next (correct in sequence one); Moving freely in space I order to arrange/read the narratives in sequence.

2019-04-18 | Public Presentation (Holodeck)

_ Research Q and Objective was briefly introduced > Qahveh Khaneh and PardehKhani were quickly introduced, types of pardeh and stories of pardeh, shahnameh and haft khan > rough thumbnails were shown

_ Main Questions/responds:

- Significance of the pardeh Khan in guiding (touring) the player through the space from curtain to curtain.
- Alice in the wonderland (reminder)
- Will Multiplayer experience still be a choice?
- What is exactly the Iranian part you are trying to bold out? What aspect?
- Prioritizing either scale or cultural aspect
- Now the theme of scale has become less central to the experience
- It's already in a good stand
- Individual playtest sessions and one to one conversations in half an hour intervals
- Invite people

2019-04-18 | Meeting with Tester #3 on HaftKhan (Haft-Pardeh) (Holodeck)

- Tester#3 mentioned http://manifold.garden
- Tester#3was impressed by the spatial design
- Changing orientation / scale suddenly, hard to find where you came from:
    - Idea of onion skinning; see the ghost-like avatar on the previous teleportation point (you moved fast, traces of your movement in the air)
    - (Tester#3 suggested even props like the bench could start to appear when you reached somewhere and when leave the spot, you could see them disappearing on the previous location in distance)
- He liked the white low texture appearance: encourages you to immerse and keep attention into the forms and lightings, and Pardeh(s)h
- maybe a slight stucco like/ paper like noise texture could still keep the same feeling while eliminating the flat computer-generated look?
- I explained the categories of teleportation types"

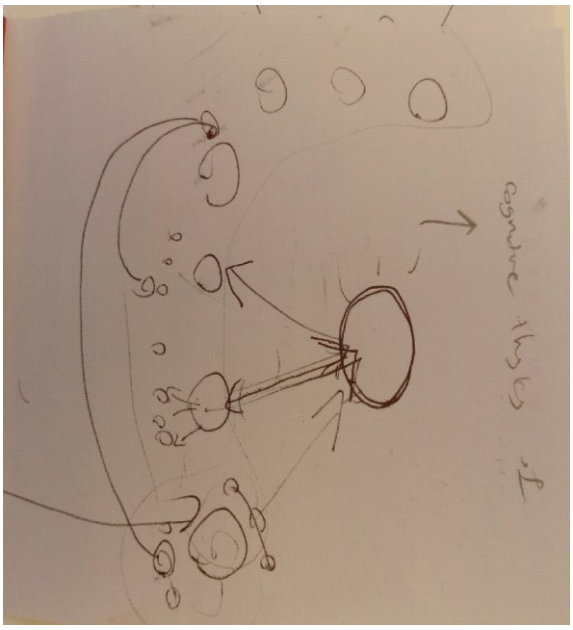
    - Mechanics of locomotion:
    - Teleport as it is (steam default) + change of appearance of teleportation points + wood stick
    - (Tester#3 suggested that when you hold the wood stick up, teleportation points appear. when you gaze at them (and/or point at them) + spelling out the word (ex: khord, setorg), you teleport to the point
        - Props on teleportation spots (throwing stuff/ archery/teacup /…)
            - (Tester#3 mentioned maybe archery is not good to be the main teleportation mechanic, as it suggests and prepares the viewer for battle/game like experience although it's a visitor/museum like experience)
            - Gaze and readout (voice recognition algorithms) encouraged by Tester#3
                - https://lightbuzz.com/speech-recognition-unity/
                - https://www.youtube.com/watch?time_continue=785&v=7caCpQ1mhOo
                - Liked by Tester#3
            - Alternative locomotion? Using controller zigzag motion to walk or juggling on spot to move
            - *HMD movement* creates movement mechanics?
                - Being able to move around is key joy of the experience of seeing geometries relationships in space (parallax)
                - Whether this is going to be a sitting or standing experience affect the navigation mechanics significantly.
                - Need to be tested and see if fits with the theme
    - Rules of navigation:
        - Tester#3 suggested controller vibration when putting it on handrail

        - Ray collision
        - active/inactive based on teleportation point and locked/unlocked *Pardehs*
        - Rotate only when you reached the end slabs/or ready to change scale only when close to small teleportation points
        - Roof gardens and terraces could also be the passages to get out and change orientation /scale
    - Controllers + HMD (physical design + virtual avatar):
        - Tester#3 suggested using valve sensor wearables instead of main controllers to track hand movement, to connect to the physical wood stick or for making the teacup tracking (detaching the cup from the dish: teleportation points visible > you could gaze or point + read out the spell > move)
        - 3d print for HMD body design (covered with Iranian motifs / calligraphy)
        - potential Title (Haft *Pardeh*)

2019-05-08 | Meeting with Tester #1 (Milieux VR Lab)

- Teleportation (change of position/scale/orientation) as the main interaction mechanics of the experience
- (more experimentation on the teleportation mechanics(transitions) taking help from Collaborator #3 & #4)
- the limitations to put on the teleportation to make the navigation more meaningful.
- He tested the experience in VR and was affected by its new architectural iteration, and found the change of scale so effective especially in small and large scales respectively.
- He didn't find adding any other architectural details in small scale so crucial, and the handrail details seems to be enough frame of reference to realize the change of scale.

- Navigation Mechanics:
    - Tester #1 mentioned that dividing each story (labour) to more than one curtain makes guiding the path more difficult as confronting small segments of the story non-linearly would not let the player make sense of the narrative.
    - directing the navigation was discussed with Tester #1, he suggested a branching map (sketch bellow)



- For the 1st teleportation, you're free to move anywhere
- For the 2nd, based on the point you've chosen, only teleportation to the curtains of the same labour is possible to choose.

- Or you could get back to the main stage in front of the large curtain (which acts as a menu), and then you will see all teleportation points to choose from.
- Idea: When you're in the menu, you could also choose from the grayed out stories to show you the relevant teleportation spots
- Idea: when you're in front of the large curtain(menu), you are the narrator (you are big) (that spelling finglish could be implemented here; only title of each story/labour maybe) and point at different parts of the pardeh with your wood stick, you could choose from the offered teleportation points of that story.
- Idea: different scales could represent your different roles (it changes your character) in default scale, you're the visitor, and you need to find you way to the main stage, in large scale (maybe only one for the main menu/stage is enough) you are the narrator, in small scale you are the traveler (Rostam-like? maybe teleportation mechanics could vary according to the story/labour, or scale, or orientation you are in, for instance archery when).

    - Find a narrative rationale for changing scale/orientation
    - Speaking of style: quill looping artworks let's say only 7, is achievable; let's say making them available after completing all series of each labour (khan).
    - Itinerary map: they could start being grayed out or having the style of other curtains and changing to final curtain look after being unlocked).
    - Tester #1 liked the idea of different visual style for other curtains, say carved monocolor molding work or tile/mosaic art except for the large curtain which remains fidel to the style of traditional Pardehs.

  _ (Escher style / particularly *Relativity*) has become an important element of the architecture: how do you justify the reason why you migrated from the 1st iteration of qahveh khaneh which was a typical one to this escheresque one? How esher is helping the objectives of this project?

    - The eseresque qahveh khaneh was fed by two independent perspectives, a cultural objective and a medium-specific question. Esher work of relativity in particular acted as a bridge to connect these two perspectives
    - the idea from the beginning was not only to adapt and translate the architecture of qahveh khaneh into VR, but to remediate (the whole ritual of the pardeh khani (utilizing the specificities of the medium (playful scales of embodiment in particular), including the architectural space of the qahveh khaneh down to challenging journey of the linear narrative of the curtains.
    - Tester#1's response: worlds of escher are loyal to the reality in the sense that they rely on the perspectives and geometries, and at the same time have the characteristics of a surreal world: this perfectly matches with what VR offers, which is an undoubtedly a spatially realistic experience which is inherited into this medium. Other screen-based mediums (like cinema, 3d animation) try to make you feel you're there by photorealistic representations (unbiased renderings) of the space, while you are instantly there in VR even if the rendering is not photorealistic.

- study more about the escheresque style in art history, his vision, his testimony and artworks (you can find even stronger rationales (how the repeating elements like tessellation, illusion relates to this project's cultural facet or VR-medium specific facets)

- Don't forget to Keep the remediation of pardeh khani alive throughout the progress; meaning the overall experience and mood should leave you the feeling of the original pardeh khani but of course with all stylized twists, using the specificities of VR.
- Draw the mind map for the spatial narrative and find its connection with the linear narrative.
- Come up with approx. experience time

2019-05-11 | Meeting with Collaborator #3(Online)

- Introduction to the Escheresque qahveh khane / distribution of Pardeh(s)/ types of pardeh/ possible rules and restrictions of navigation / HaftKhan and idea of several pardeh for one Khan/ finishing each Khan = one 3d vector art animation tableau as reward / challenge of confusion long distances, especially if coupled with change of scale and orientation, solution = animated ghost like track

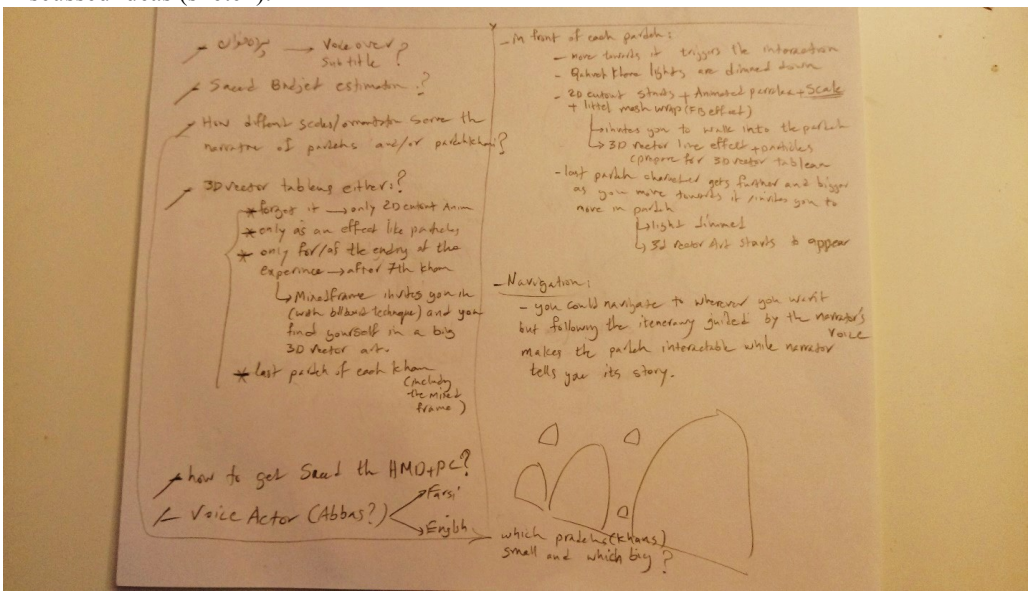
- LOCOMOTION / TELEPORTATION is the main interaction mechanic of this experience.
- Setting spatial narrative & navigation rules/mechanics is the current phase
- Possible locomotion styles: prefer to get rid of controllers and rely on the HMD movement/gaze, Challenges of showing transition in teleportation. / how much rely on the steam VR teleport and how much change we apply.
- Potential visual/interaction style with each pardeh (gave him examples of my experiments, cutout, talking about the 3d vector software: tilt brush, quill, Mehdi said there is a new app from WMR to do that too.)

Next Milestones:

- Keep the museum of *Pardeh*/ pardeh khani / and Qahveh khaneh in mind
- Keep the notion of scale and embodiment/ scale as an interactive attribute in mind
- locomotion/ teleportation experiments options/potentials > be playful/be relevant to the theme/ doesn't cause motion sickness
- experiments with 3d vector apps / advantages and disadvantages / and decide for one best suits this project.

2019-05-26 | Meeting with Collaborator #2 (Online)

- Collaborator #2 proposed the style if **چاپ سنگ** for 2d billboard *Padehs*.
- **امیر حمزه دلدار و گور دلگیر** Collaborator #2 introduced
- Questions:
  - Keep 3D Vector style or not?
  - for the end of each khan or after all journeys?
  - How to get Collaborator #2 HMD and PC? Voice Actor?
  - Which Pardeh(s)should be small, which one big? How related to the story of that pardeh, how related to the notion of scale as cinematic shot framing device?
- You could still navigate through all teleportation points but Pardeh(s)remain still (non-interactive) but only those guided Pardeh(s)in sequence are unraveled by the narrator (intractable)
- Discussed ideas (sketch):



2019-05-29 | VR Show & Tell Event (Milieux)

- Started with a brief introduction of the artists and their projects on the Milieux' common public lounge at 11th floor.
- a small poster and a large screen to duplicate the screen was set.
- ~30 people were gathered, and nearly 15 people tested the escheresque Qahveh Khane,
- (reminded the old apparatus of **شهر فرنگ** old VR like mediums), ….

- Almost everybody's first reaction by the start, play was wow! (visceral effect) The visceral engagement was achieved immediately. Everybody was affected by the architectural space, lighting and the overall atmosphere, quality of the imagery. Some stated it has been their best VR experience. They mostly interpreted it as a spiritual/calm place.
- Most of them said they want to keep staying in the space and wander around. >> free navigation shouldn't be taken away.
- Idea of scale and orientation was well received.
- Some suggested if a rule/role/goal is introduced for the player to follow alongside with the linear narrative of the Pardeh(s) (which was absent in this stage), the [challenge based] immersion would be fostered; they mentioned the space is already a maze. They also found anything connected to the notion of scale working; for instance, looking at small Pardeh(s)while you're big. Or teleporting from very small to very big size. Or even looking at different scales of figures on the curtains.
- The colorful pardeh paintings were appreciated.
- Some enjoyed the curtains even without the interactions or animations. Felt like a cathedral.
- Some asked about the relationship of Escher and Qahveh Khane.
- Some believed that the Escher feeling is very dominant. >> still elements of Qahveh Khaneh and pardeh khani are missing, to give the balance. exploiting more the VR capacities, meaning the embodied experience through changing gestures. (reminded the SuperHotVR), as if they also were looking for another locomotion style which invites more movement, or more unique to be like game based teleport.
- Possibility of alternative locomotion styles were also coined by some people. They enjoyed walking around.
- The same way the viewer tilts their heads up to see huge curtains, they also enjoy bending and changing their body gestures to see the small works, >> an idea is to introduce larger scale points or make the default scale more randomly
- Some also mentioned the idea of knowing which spots have already been exploited, like teleportation points color, etc.
- Some mentioned the idea of collaborative experience; engaging visitors in que; how to invite them prior to their VR experience, or include some of them in the experience while being outside (now the only thing is the common engaging spot for the visitors is the duplicate screen).
- Hand avatar and teleportation points design need to be customized.
- Blocked teleportation points on the back sides were sometimes tried multiple times, they thought they could travel to but they couldn't. >> design of the teleportation points on the back sides of the walls should more clearly afford they are out of reach.
- Some stated that although they don't typically enjoy VR contents, they don't want to leave this space.
- they all very much liked the overall experience and didn't want to stop it. (seems there is already a balance in all types of immersion)
- Some mentioned the effectiveness of being large and bending your body to see the small curtains. >> large scale spots need to be more
- They also liked the interaction prototype. Some wanted to continue walking toward pardeh canvas. They liked the Samsung ergonomics more than the Vive.
- Some suggested using the female voice for the narrator. Could be also proper for children's books. the voiceover from the audiobook (Hamid Rahmanian)

2019-06-11 | Meeting with Collaborator #4 (last day state) (Holodeck)

- Agreed Pipeline: Export Tilt Brush Characters to Max/Maya > Rig/Animate > To unity > Shaders
- LightWeight Render Pipeline which then decided to leave aside:
    - http://www.ashleypinnick.com/tilt-brush-public
    - https://www.youtube.com/watch?v=taMp1g1pBeE
    - https://www.youtube.com/watch?v=gYGZlIjEs7E
    - https://www.youtube.com/watch?v=mkrXZecx9SY
- Modified Tilt Brush Shaders: Dr.Wiggle , Fire, Smoke , comet, streamer, electricity, waveform, chromatic waveform, neon waveform, Disco
- 4 types of dissolves were integrated which will be used depending on the type of Tilt Brush shaders:
    - Texture dissolve (using noise and ramp texture)
    - Fading dissolve (using emission and gain slider)
    - Directional dissolve (following the direction of the strokes, which might be applicable to all)

    - Particle dissolve (play with the number of particles, or using a simple fade)
- Each gate represents a certain scale, speed of scale animation is pertinent to the thickness of the gate
- Activation of small and large scale teleportation points depends on the gate you are entering
- Scale change was detached from the steam teleportation mechanism
- LERP animations were added to the Steam teleportation script
- Still the design and position/orientation of the gates inside the virtual space is critical in order to assure a smooth trajectory of the player without getting stuck in the corners of the physical space
- The method for calling the player back to the center before each teleportation should also be designed (audio/visual trigger)

2019-06-11 | Meeting with Tester #5 (Milieux VR Lab)

- She couldn't always find out if she is getting bigger or smaller
- Sometimes scared when not grounded
- Scale is still disconnected from the storyline (which is obvious as the focus till now has been on the architecture)
    - Solution: scale as a core theme should exist everywhere: (Architecture and teleportation / interaction with *Pardehs*/ illustration of the *Pardehs*/ characters of the Pardeh(s) (cinematic use of scale)
    - Didn't feel qahveh khaneh (Escher is more dominant than qahveh khaneh):
        - Absence of rich textures/ whiteness
        - More qahveh khaneh specific features should be present (more pointed arcs/ benches, narrator voice/ tea & coffee related props/ carpets/...
    - The overall feeling is still static (which again is obvious as the interaction with Pardeh(s)and animations of both characters and VFX is not there):
    - Absence of Crowd / narrator/ moving objects (wind/dust/light) / SFX
- She was excited about the physical installation and mentioned the curtain as the keyword for the HMD cover/ main curtain installation as introduction> 1st. The physical hanging pardeh invites people to get close to the HMDs which are close to the curtain.
- She also mentioned the huge scale of the project and that it should be approached iteratively.
- She encouraged playing and experimenting with many different styles during the summer (look and interaction mechanics) to choose from in the fall.

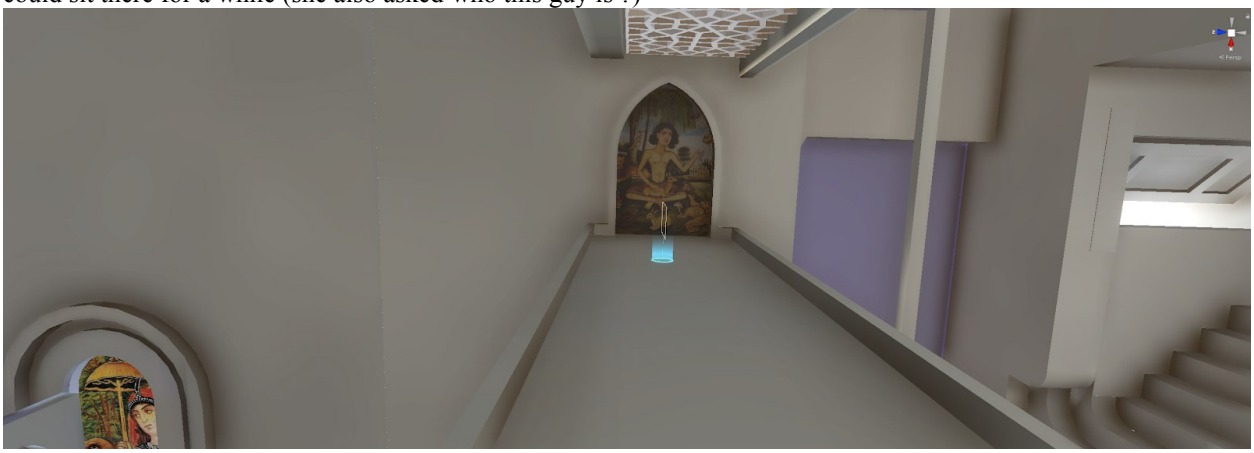
2019-06-13 | Meeting with Tester #2 (Milieux VR Lab)

- Liked the architecture and spent more than half an hour inside
- Also reviewed the VR show/tell event feedback form others
- Also mentioned the fact that the Escher feels dominant. Which I explained its relevance due to the affordance it has for playing with the scale, genuine connection to the architecture of Qahveh khane, and connection of particularly the *Relativity* work to the very essence of immersion in VR which is based on an illusion (of stable[plausible] spatial space though looks impossible, and embodiment within a space in which shouldn't be possible to freely navigate around due to the multitude of gravities)
- He Liked the extreme scales at very small and very big as they are inviting to change the posture
    - He liked seeing his avatar + shadows (hand at different scales), reflection of the pool of water could emphasize that
    - He also liked staying at the edges and looking downwards
    - He wanted to touch things / surfaces
    - Like the idea of vibration of controllers when touching the handrails
- Scale is giving the visceral effect as well as playful interactive one, the cinematic one still remain to be explored, especially when in front of the characters of 3d vector art
- Experimented with changing the location and scale while Tester #2 in VR:
    - Fast transition of movement seemed to be working
    - Fast transition of scale didn’t feel ok (Maybe due to slight change of coordination (pivot issue))
    - transition and scale change to be tested both with Collaborator #4

2019-06-14 | Meeting with Tester # 6 (Milieux VR Lab)

_ Tester# 6 “Loved” the architecture of the space, stated that she “want to stay forever” in this place

- She liked the lighting
- She very much liked being small (perhaps big size is not big enough) and not many in number
- She didn't find losing track of where you are coming from so vital, and said “I want to get lost in this space”
- Like Tester#3 and others, some spots gave a sense of place: she liked this spot (image) and wished she could sit there for a while (she also asked who this guy is ?)



2019-06-14 | Meeting with Collaborator #5 (Holodeck)

- We spoke of how the whole experience could be more experimental, surprising, adversarial, critical and unique by combining the story of shahnameh (HaftKhan) and Karbala.
- It will be an effort to reconcile two cultural and belief systems among Iranians within a single narrative; these are the Shia Islamic and Zoroastrian pre-Islamic culture which Iranians often associate themselves with either one or the other; Such dichotomy was especially the result of a colonial course that occurred after the Arab conquest. It amplified the racial battle and mudded the political climate to a point where it was not easy to all Iranians to comprehend the fact that the leaders of Shia Islam had also been rejected by the same Arab leaders who invaded the Persia.

The Persian territory turned to be the land of those oppressed Iranians with Pre-Islamic cultures and also Shia leaders and followers who both drew on different forms of dramatic storytelling in order to pass their values to the next generations. Pardeh khani has been the most significant ritual which was nurtured by both schools of thoughts somehow in a competitive fashion. Nonetheless, there have been Pardeh painters and Naqqals who were popular for illustrating and narrating the stories from both contexts due the abundance of shared values of bravery and valiance. However, these stories were told independently, and there has never been (as far as I know) any experimental initiative to marry these shared values in a single narrative.

2019-06-16 | Meeting with Collaborator #2 *(Online)*

discussion went around following concepts:

1. Pseudo-static style
2. Theatrical aesthetics
3. Amalgamating of performative and painterly styles which were all being developed in parallel historically and all fed into the ritual of pardeh khani

Points discussed:

- where the characters are in fixed poses while they’re alive and there are some movements here and there (in form of character movement & VFX)
- Collaborator #2 mentioned *Tableau vivant (living picture)(*https://en.wikipedia.org/wiki/Tableau_vivant) which revolves around the theatrical mise en scene/composition of actors and props which seem to be static

but still have slight movements (like blinking of the actors , fabric movement, …..) – so there is a temporal component into it (a loop)

- It is an art form in postmodern context
- It reminded me of the sceneries of the Iranian photographer Azadeh Akhlaqhi : https://fa.wikipedia.org/wiki/%D8%A2%D8%B2%D8%A7%D8%AF%D9%87_%D8%A7%D8%AE%D9%84%D8%A7%D9%82%DB%8C
- He also mentioned *The Color of Pomegranates* by Sergei Parajanov https://www.youtube.com/watch?v=YR-yEXUPePI
- *Losing my religion* music video
- It also reminded me of the *Easter Rising: Story of a Rebel* which is based on the photogrammetry style
- The theatrical/unreality of it is intentionally brought to the surface
- Collaborator #2 reminded me of the film *The Fall (2006),* in which the audience is informed with the factitious and artificial nature of the stage https://www.imdb.com/title/tt0460791/
- reminds me of the Barry Purves *Screenplay:* https://www.awn.com/animationworld/keep-it-motion-classic-animation-revisited-barry-purves-screenplay
- Brainstorming the idea of a mixture and overlays of various aesthetics from **چاپ سنگی، تعزیه (تکیه) و پرده خوانی** and also emphasizing the theatricality of the whole experience; ex: after finishing each khan, you see the characters and/or their props in the qahveh khaneh space getting prepared for acting in the next khan ex: Rakhsh is a human with a horse mask, or props are made of artificial materials, water feature is made of fabric for instance.

- There are issues to be considered though:
    - The point is that there is already existing realism (like real characters) in the scenery which is intentionally interrupted and suspended by an emphasis on the artificiality of the stage (example from **تعزیه**: audience see imam Hossain drinks water off the stage, or you see the lion of the 1st khan of the 7 labors of Rostam that is sitting somewhere taking off his mask and drinking tea, while preparing to wear the dragon's costume)
    - This could work perfectly if we decide to go for photogrammetry/volumetric capture style coupled with basic rigging/slow animation/VFX simulation (particle, wiggling, ….)/ mild interactivity, …
    - However, Pardeh khani consist of three main components, each of which are required to be visible to the audience in order to reproduce the same original feeling of the ritual:
        - The dramatic performance of the Naqqal (theatrical aspect)
        - Illustration and craftsmanship of the Pardeh(s) (painterly styles, refer to the 7 styles diagram: starting with 2d flat paintings (, cutout & shadow puppet, to 3d Vector art (VR painting)
        - Originality/criticality of the narrative content (choosing the 7 labours of Rostam, possibility of critical juxtaposition and reconciliation of two main references of pardeh khani stories: pre Islamic and Shia literature
    - Besides, with the premise of SCALE (of embodiment, cinematic quality, visceral effects) as the medium specificity of VR, all SCALE should be integrated in the stylistic decisions and become an integral part of the Dramatic, Visual and Narrative of the experience.
        - Collaborator #2 mentioned the Idea of very huge characters; Hotel Transylvania (only legs are visible inside the frame, Gambal huge character)

Keywords & References:

- سبک التقاطی (پرسپکتیو مقامی، پرسپکتیو عمق) – همپوشانی زیبایی شناسی بین رسانه ای (پرده خوانی، چاپ سنگی، تعزیه(نمایش آینی، شمایل گردانی، تکیه) ، چاپ سنگی، عکاسی های آزاده اخلاقی

- Hybrid style (real, stylized), Tableau Vivant, Michel Gondry works, Barry Purves *ScreenPlay,* Tarsem Singh *The Fall (2006),* Sergei Parajanov's *The Color of Pomegranates, BBC Easter Rising; Story of a Rebel*

2019-07-05 | Meeting with Collaborator #6 (Potential Voice Actor) (Online)

- Having one voice in different roles seems more relevant to the pardeh khani as it is the pardeh khan who changes his/her role all the time (but we could have two Naqqals; male and female)

- Crowd used to be an important part of QahvehKhaneh and also as the audience of the pardeh khani, at least the ambient sound of the crowd (tea serving and reaction to the pardeh khan, revealing parts of the stories) so the player could be understood as being contextualized in a tour among other visitors led by the Naqhal.
- visually speaking, crowd could also be represented as ghosts occupying the 3d space, they could act as cues to the next pardeh (Maareke Giri; they gather where naqqal starts talking)
- Collaborator #6 mentioned the Shahre Farang (which could be considered as the origin of the VR and also the context of Mareke Giri and Naqqali)

-- Next Subject would be about the Time Frame for each Pardeh
-- Say 7 (khan) * 3 (pardeh) = 21 pardeh for the narrative / other pardeh could be decorative and static (or even related to the side religious narratives)

2019-07-06 | Meeting with Collaborator #5 (Milieux VR Lab)

- Collaborator #5 tested teleport system and Tilt Brush test animation:
  - She enjoyed navigating around
  - Not very well noticed the scale difference, as the space is complex enough that changing scale somehow gets invisible, some more solid visual, acoustic, kinetic cues might be required
  - Design of the Teleportation for those points dedicated to 7 khan narration could be different than those only set for exploration of the space. (Narrative vs Exploitative teleportation points)
  - For the narrative teleportation mechanic, Rakhsh could be a part of the design; avatar of Rostam and Rakhsh in the previous spot (ghost like), or avatar of Rakhsh runs towards the pointed teleportation and when reached, you move too.
  - For the explorative teleportation mechanic, decorative elements like calligraphy is one way to go.
  - She was looking for her role and responsibility in this experience like other gamers. As for the interaction ideas she brought the concept of props out of each pardeh or khan:
  - After each khan, an element of 3d artwork (a prop) remains to be picked up by the player; either used to fight with Dive Sefid or to be added to the Main Pardeh stage

2019-07-05 | Meeting with Collaborator #3 (Online)

- Interaction with pardeh starts with 2d billboard style to fully 3d art for the last pardeh of each khan.
- Physical movement in space and gaze based mechanics, which are all HMD-dependent will be the key to interaction with pardeh, locomotion and uniqueness of the whole experience (that's why the scale change based on movement inside gates might be a better solution)
- There could be Variations for the way each pardeh encourages you to walk:
  - Prototype 1: Moving towards pardeh creates the layers extrude out with different scales (parallax effect)
  - Idea: different distances and scales of the drawing parts which encourages you to walk around and find the perfect spot where the complete image is created (illusory effect: fits well with the illusions of escher perhaps)
  - Time triggers: walking around or towards the 3d artwork/ 2d billboards is wired to time moving forward (like scrubbing / scrolling)
  - Think and create fast prototypes of other interactions which invites movement/embodiment of the player + playful use of scale + light/movement/sound

- Decided to start with two scenes; one for the architecture/ and one for the interaction prototypes (we may need more than one prototype project file in order to prevent conflicts / or create branches)

2019-08-05 | VR Show-Tell Event for Seniors (Milieux Resource Room)

. conducted by Naj Mahani I was invited to present my work
. ~8 seniors (above 60), + one middle-aged and one Young girl tested it.
. They were astonished by the architectural aesthetics, and overall very enjoyed the experience and certainly wanted to try again and again until all the spots and Pardeh were explored.

. Both seating and standing was tested, on the rolling chair they felt safer, but sometimes they just wanted to stand and walk in the space.
. They wanted to get close to the paintings (and every other thing like walls and handrails) and touch them, so interaction with Pardeh(s)would definitely add to the experience, and vibration warning is a good idea.
. They were also more impressed when they were small.
. They were enjoying the colorful paintings on top of the white architecture(background).
. They still wanted to know about the narrative and ask about the relationship between the characters.
. The teleportation points behind the walls are confusing.
. The height was frightening to some of them yet with excitement.
. The off center issue must be solved; when they start to walk off the center and decide to teleport. they get off centered in the new teleportation point, and if it's a bridge they're basically jumped into the midair which they don't like, or may pass through surfaces. Even when they were big, they sometimes felt floating and scared.
. Teleportation mechanic is not familiar to first time users:
. most of them were pointing at the paintings to get there instead of interacting with teleportation points. This could be considered as an interactive mechanics for approaching the paintings

2019-08-12 | Meeting with Collaborator #1 (Online)

- Other than in story characters; also added Naqqal and Ferdowsi who could have roles in 2d/3d paintings.
- Since the architecture allows for many Pardeh(s) of different sizes, I asked to divide the story on as many as possible Pardeh(s), and keep the compact and detailed one for the main mixed frame pardeh.
- Qahveh Khaneh available arches/frames at the current stage =
    - 58 total pardeh
    - 7 fairly bigger (including the main mixed-frame one)
    - 10 medium
    - 12 small sizes
- The more they are scattered and more in number, the more the architecture should afford and encourage exploration and navigation through the space which is already the key exciting feature of the experience to the audience.

2019-08-13 | Meeting with Collaborator #3 (Online)

- the main navigation line dedicated to the story of haft khan and branching spots outside the main line were discussed:
- for non-narrative branches;
    - Narrator could always talk to us even if we are not following the linear story (like Stanley Parable, narrator could also bring some sense of humor and fun)
    - Narrator could give us hints back to the main linear narrative or other info as a tour leader
    - Nonlinear Pardeh(s)could reveal
        - aspects of the main characters
        - Introduce characters outside haft khan (from shahnameh, or pardeh religious narratives)
        - Narrator could read poems in Farsi
        - Pardeh(s)could be merely decorative
    - Options that could help the viewer find the main track back:
        - Music change (or fade)
        - Footprint
        - Teleportation points colors and design
        - Naqqal hints

2019-09-04 | Meeting with Collaborator #3 (Online)

Suggestion for gaze/gesture based interaction > idea: change position to correct the distorted artwork.

- The exact position where the final artwork is created becomes important
- The distorted artwork should be considered an artwork on top of architecture

- Lines are better not to be separate objects but one continuous drawing distorted in 3d app and using morph (blend shapes) smoothly corrected as the player walks into the right spot.
- How can the player understand the interaction logic (with the help of narrator/sound hints or lighting strategy)?

- Interaction with pardeh ideas review:

1 - Dissolve (Collaborator #4 work)

2 - Gaze based illusion (Collaborator #3)

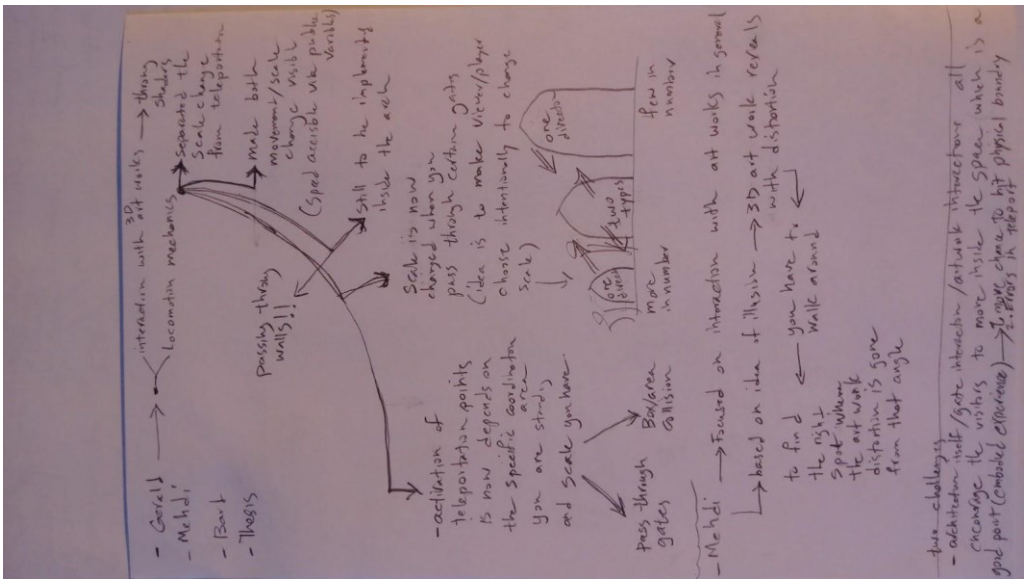
3 - Light and shadow (remote lights moved and affected by the player's movement so that the desired silhouettes are created)

4 - touching the curtains when approached very close activates some sort of effects (from the playtests, it seems that all players have a tendency to touch the paintings when getting close)

5 - Frame removal (Art Plunge, FB 3d images, Tales of Wedding Rings VR, Traveling while Black,)

Levels of interaction as an idea:
concluded with the idea of having the *Frame Removal* as the main interaction with pardeh and after getting into the world of painting, *Gaze based Illusion* will encourage the player to walk and after that we could still have third layer of interaction which calls for *player's gestural interaction* which controls Rostam's gesture and narrator continues.

2019-09-14 | Meeting with Tester #1 (Office)



- Update Tester #1 with following (Scanned)
- We also talked a bit about the thesis writing > different approaches were discussed
- In design research creation thesis, the chronological report itself -which demonstrates the trajectory of intellectual (cognitive/academic) and creation(making/technical) thoughts- is a good method of justification of why and how the final creation is what it is.

2019-09-25 | Meeting with Collaborator #3 (Online)

- Review the previous interaction mechanics, shadow mechanics particularly
- Next steps:
    - will finalize the Frame-Disappear interaction in a few days,
    - We will put aside what we have in terms of interaction with Pardehs; illusion-gaze, shadow gaze, Frame-disappear + Dissolve interaction (Collaborator #4) as the main package of interaction with 3d artworks
    - We will wait for a sample 3d art work to implement all 3+1 interaction types inside the qahveh khaneh architecture
    - Meanwhile, we will jump into navigation/locomotion tests; starting with what Collaborator #4 came up with:
- Our next meeting will be around the Frame-disappear interaction as well as possible challenges of integrating the locomotion mechanics done with the help of Collaborator #4 (with transition LERPs + gate-scale mechanics) inside the QahvehKhaneh architecture.

2019-09-29 | Meeting with Tester#1 (Office)

- The 1st prototype of Frame Disappear was tested:
    - The image was 2d and interactive based on *art plunge* example
    - The Tilt Brush dissolve should become slower

- will work on another prototype, based on *tales of wedding rings:*
- there will be two worlds overlapping (qahveh khaneh and 3d artwork of that particular khan.
    1. the closer you get to the window, the wider the frame will become until it will wrap all over and you find yourself inside the 3d art world. (distorted 3d art yet)
        - Here the dissolve effects (done by Collaborator #4) could be happening in parallel; so as you get closer, the 3d art work will also get clearer. (distorted 3d art yet)
    2. Gaze illusion; You are encouraged to walk around (within the physical boundary) and find the right spot where the 3d art work gets out of distortion.
    3. You will have some time to explore the 3d art work while the narrator tells you the story which either:
        a. Will be revealed in different scales for each khan
        b. Or by the moment the 3d art work is clear, a non-interactive 3d art film starts to play, using different scales of the same art for dramatic/cinematic effect.
        Option looks like a better option.
    4. After the narration is done, a similar window to the qahveh khaneh space is visible and invites you to walk in, the closer you get the wider the window becomes until you are back inside the qahveh khaneh. This window is placed right in the middle of the physical space, so that your coordination relative to the physical space will also be reset by getting out of the 3d art world.
    5. It is still a question that how should the 3d art work still be visible, or instead the 3d art work is now replaced by a 2d artwork as a sign that the interaction with that art work is done?

2019-11-19 | Meeting with Tester #1 and Collaborator #1 (Milieux VR Room)

- Talked about the new direction taken:
    - Main *Pardeh* 2D and Main *Pardeh* 3D art work to be placed against each other at two opposite sides of the QahvehKhaneh architecture.

- All 3d Tilt Brush khans create one Large Tilt Brush composition with infinite background, last khan (fight with Dive Sefid, or maybe Dragon) is drawn in the middle with the huge size of Div which is an evidence to the effectiveness of the spatial composition in VR and effectiveness of the notion of scale when compared with the conventional 2D pardeh (on the opposing side):
- Which had to compromise the scale because of the established visual language and restrictions of the time
    - Important characters should be exaggerated and drawn bigger
    - No element (including characters) should be cut by the borders
    - Impacts of the rulers (clerks)
- Both main 2d and main 3d artwork are updated visually after each khan is finished
- Tester# 1 proposed that after each khan is finished some visual trail towards the main 3d Artwork
    - Could fly aslo towards main 2d painting perhaps?)
    - The visual style of the trail could be the Tilt Brush (procedural type) drawn in the qahveh khaneh space with the directional (vector) transition effect.
    - It could have calligraphy particle effects.
    - The trail could also relate visually to the teleportation trail.
    - Could be accompanied with a spatial SFX (guide our visual and auditory attention)
- All 2d Pardeh(s)of each khan (Collaborator #1 drawn) will be compacted and shape the composition of that khan; so each khan like the main pardeh will also follow the conventions of mixed frame pardeh visual language.
- Tester# 1 also tested the scale change mechanism (using the grip and also the gate)
    - Both felt exaggerating motion sickness
    - Transition animation between teleportation points seem to be working (as they are fast)
    - Each mechanism tested so far has advantage and disadvantage, giving the agency to the players (from previous which integrated to the teleportation points > to scale changer gates > to more immediate and intentional scale change through climb gesture which for him felt literally like raising the height than changing the scale)
    - Challenge of different audience with different expectations of agency was discussed
    - *Museum metaphor* seems to be the one I am constantly referring to which is somewhere between the full spectrum of least agency and mere spectatorship in cinema (for Daniel like filmmakers) to fullest agency and responsible role in video games (for game designers)

Hints from Tester# 1:

- 1st: Concentrate on the design of one of the 2d mixed parde (khans) with all its interactions and voice over and maximum time it requires to finish and final effect
    - It gives a sense of full experience time
    - The experience time is also affected by the target platform; is it targeting the exhibition? it targets platforms like steam and oculus for the sake of accessibility and exhibited in final expo and other exposition as a part of exhibition design together with its process and iterations (including its process VR)
- 2nd: main 3d art work
- 3rd: the main 2d pardeh
- 4th: final tweaking of the navigation mechanics (and decision for the scale mechanics) which seems working